IVAC® Variable Pressure Volumetric Pump

Models **571** & **572**

Technical Service Manual

CardinalHealth

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Contents

Chapter 1 Introduction & Start Up 4

Chapter 2 Configuration & Calibration 13

Chapter 3 Routine Maintenance 22

Chapter 4 Troubleshooting 37

Chapter 5 Circuit Descriptions 43

Chapter 6 Spare Parts Replacement Procedures 47

Appendix A Specifications 83

Appendix B Spare Parts Listing 89

Appendix C Configured Options 97

Appendix D Disposal 99

Appendix E Service Contacts 101

Appendix F Document History 103

Chapter 1

Introduction and Start Up

In this chapter

Introduction	5
General Precautions	6
Views of Models 571 and 572	6
Controls and Indicators	8
Loading the IV Infusion Set	9
Starting the Pump	9
Programming	10
Operating on Battery Power	10
Secondary Infusion (Model 572)	11
Flow Sensor	12
Pole Clamp Accessories	12

Introduction

The IVAC® Volumetric Pump - Models 571 and 572 automatically regulates the infusion rate of IV solutions using a linear peristaltic, volume displacement mechanism to regulate fluid flow at the prescribed rate. The pump can be operated with a Flow Sensor and is compact and robust enough for most patient situations.

The IVAC® 571 Volumetric Pump operates in primary infusion mode only.

The IVAC® 572 Volumetric Pump has a primary and secondary infusion mode.

Product Familiarity

Ensure that you are fully familiar with the pump by carefully studying the *Directions for Use (DFU)* prior to operation and prior to attempting any repairs or servicing. As part of continuous improvement, product enhancements and changes are introduced from time to time.

Purpose of this Manual

This Technical Service Manual describes how to set up, test and maintain the following IVAC® Volumetric Pumps:
Model 571
Model 572

This manual is intended for use by personnel experienced in medical equipment testing and maintenance procedures.

Conventions Used in this Manual

BOLD	Used for Display messages/values, self-test codes, controls and indicators referenced in this manual, for example, **CAL RATE**, test code **11, ON/OFF** switch.
'Single quotes'	Used to indicate cross-references made to another section of this manual. For example, see Chapter 2, 'Configuration and Calibration'.
underline	Used to indicate a link to another section within this manual.
Italics	Used to refer to other documents or manuals. For example, refer to the relevant *Directions for Use (DFU)* for further information. Also used for emphasis, for example, ...if the gap *still* measures less than...
	Wherever this symbol is shown a Hints & Tips note is found. These notes provide useful advice or information that may help to perform the task more effectively.
	Wherever this symbol is shown a Toolbox note is found. These notes highlight an aspect of test or maintenance that is important to know about. A typical example is drawing attention to a software upgrade that you should check has been installed.

General Precautions

Prior to using this pump, carefully read the Operating Precautions described in the *Directions for Use (DFU)*.

This pump contains static-sensitive components. Observe strict precautions for the protection of static sensitive components when attempting to repair and service the pump.

An explosion hazard exists if the pump is used in the presence of flammable anaesthetics. Exercise care to locate the pump away from any such hazardous sources.

Dangerous Voltage. An electrical shock hazard exists if the casing of the pump is opened or removed. Refer all servicing to qualified service personnel.

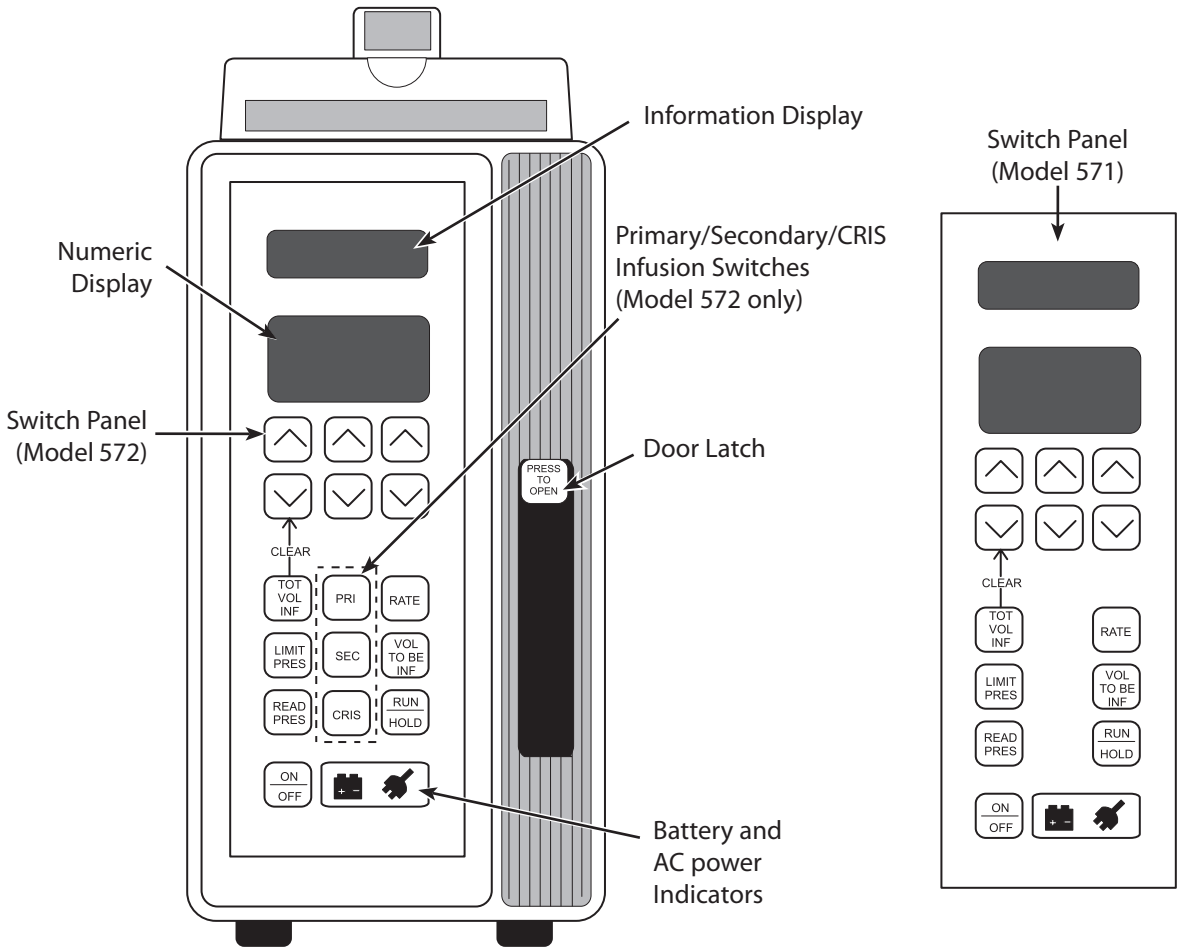
This pump is protected against the effects of radio frequency emissions and is designed to be fail safe if extremely high levels of interference are encountered. Should false alarm conditions be encountered, either remove the source of the interference or regulate the infusion by another appropriate means.

If the pump is dropped, subjected to excessive moisture, humidity or high temperature, or otherwise suspected to have been damaged, remove it from service for inspection by qualified service personnel.

When connected to an external power source, a three-wire (Live, Neutral, Earth) supply must be used. If the integrity of the external protective conductor in the installation or its arrangement is in doubt, the pump should be operated from the battery.

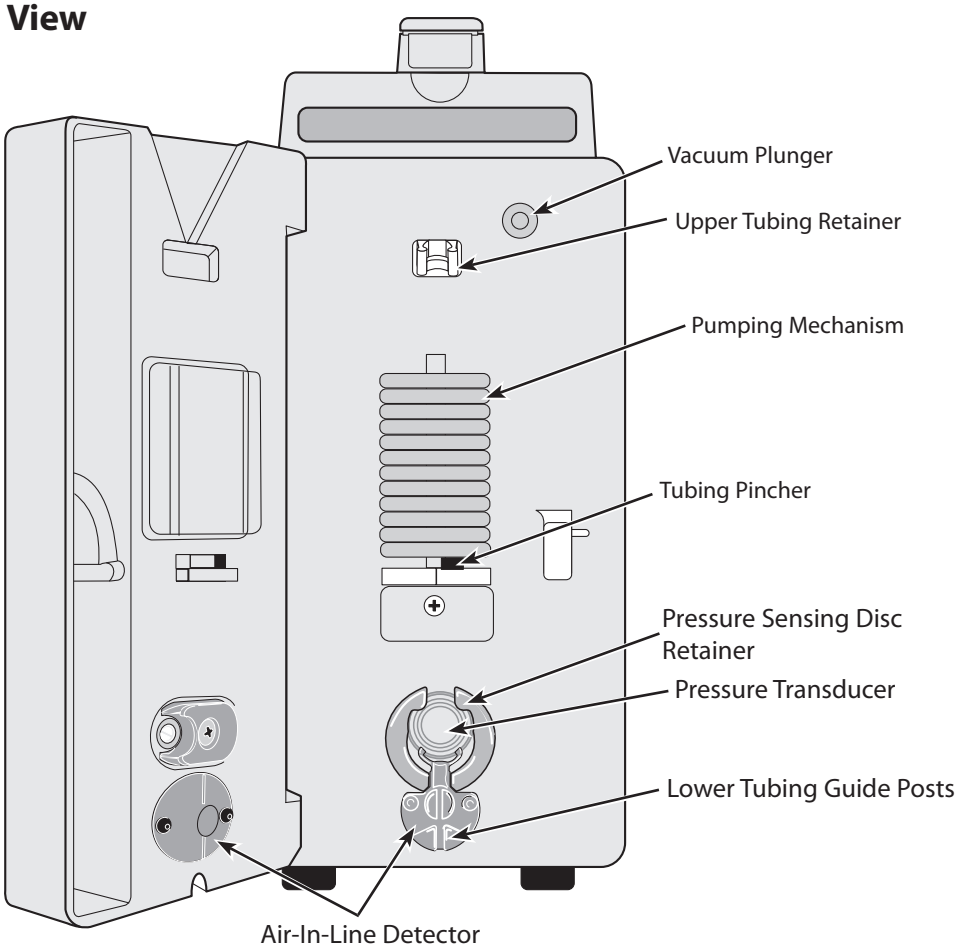
Views of Models 571 and 572

Front View

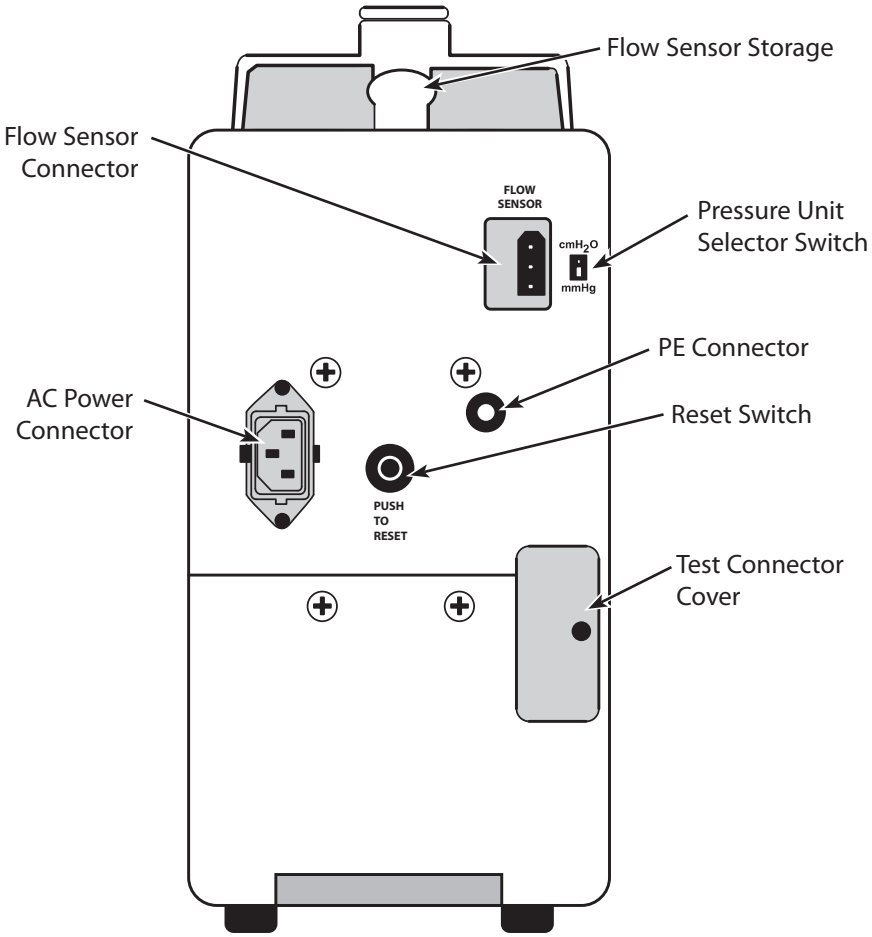


Views of Models 571 and 572 *(continued)*

Open Door View



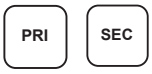
Rear View



Controls and Indicators

Front Panel

The English switch panel controls and indicators are described below. For information on overlays in other languages, refer to the relevant DFU. See also Appendix B, 'Spare Parts Listing' for switch panel part numbers.

	UP/DOWN	Increases or decreases infusion rate and pressure and volume values. Three columns for faster/slower increase or decrease: Left = 100's, Centre = 10's, Right = units (or in micro mode Left = 10's, Centre = units, Right = fractions).
	CLEAR	Clears total volume infused when both switches are held down together.
	TOTAL VOLUME INFUSED	Displays total volume infused value (primary + secondary volume infused). Sets the Information Display to continuously monitor volume infused.
	PRESSURE LIMIT	Displays or changes the occlusion pressure alarm level limit.
	READ PRESSURE	Displays the IV infusion site pressure. Sets the Information Display to continuously monitor infusion pressure.
	**PRIMARY/SECONDARY**	(Model 572 only). Switches between PRIMARY and SECONDARY infusion modes. Allows displays of VTBI or rate setting of one mode while operating in another.
	CRIS	On Model 572: only used in Self-test mode. On Model 571: hidden switch, only used in Self-test mode.
	RATE	Changes the infusion rate.
	VOLUME TO BE INFUSED (VTBI)	Sets the value of Volume To Be Infused. Displays volume remaining to be infused.
	RUN/HOLD	Starts and stops pump infusion. Silences/cancels alarms and advances start-up instruction messages.
	ON/OFF	Turns the pump on and off.
	AC POWER INDICATOR	When illuminated, indicates the pump is connected to an AC power supply and the battery is being charged.
	BATTERY INDICATOR	Flashes to indicate the pump is operating on battery power.
0	With a Flow Sensor in use, an illuminated ("0") in the Information Display window indicates a drop is detected by the flow sensor in the drip chamber.	
Flashing Displays	When the pump is operating on battery power, both Displays flash on/off.	

Rear Panel

	PRESSURE UNIT SELECTOR SWITCH	Sets the displayed pressure units. Millimetres of mercury (mmHg) or Centimeters of water (cmH_20).
	RESET SWITCH	Resets the circuit breaker.

Loading the IV Infusion Set

- **Follow the *Directions for Use* supplied with the individual IV infusion set**
- **Only use IVAC® "52" Series IV infusion sets**

1. Prime the IV infusion set ***slowly*** ensuring all air is removed from the pressure disc then close the roller clamp.
2. Open the door.
3. Load the primed IV infusion set (see Figures 1-1 and 1-2):
   - Insert the set tubing into the upper tubing retainer.
   - Grasp the pressure sensor disc tabs between thumb and forefinger with the flat side (membrane) toward the pump
   - Hook the pressure sensor disc under the disc retainer then press up and in to properly seat the disc
   - Place the tubing between the lower tubing guide posts.
4. Close and latch the door.
5. Open the roller clamp. ***Check drip chamber to ensure no fluid flows***.
6. Connect to test equipment as required.

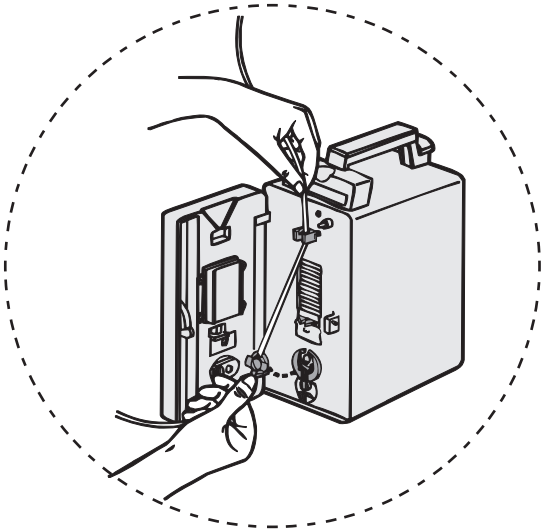


Figure 1-1

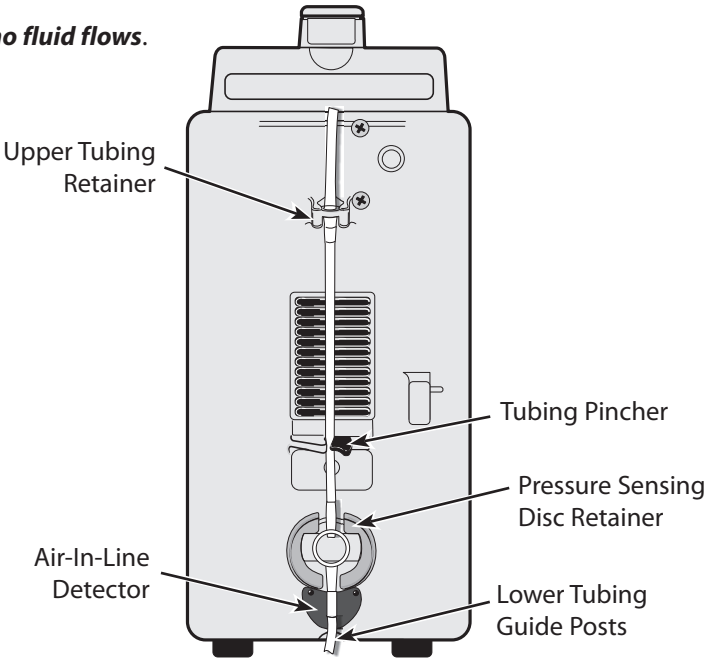


Figure 1-2

Starting the Pump

Without Flow Sensor

1. Load the primed IV infusion set.
2. Press the **ON/OFF** switch to power on the pump.
3. Use the **UP/DOWN** switches (^ v) to set the rate.
4. Press the **RUN/HOLD** switch to confirm.
5. Use the ^ v switches to set VTBI.
6. Press the **RUN/HOLD** switch twice to start infusion.

With Flow Sensor

1. Load the primed IV infusion set.
2. Connect the flow sensor to the drip chamber ensuring the flow sensor is plugged into the pump.
3. Press the **ON/OFF** switch to power on the pump.
4. Use the **UP/DOWN** switches (^ v) to set the rate.
5. Press the **RUN/HOLD** switch to confirm.
6. Press **VOL TO BE INF** (if required) then use the ^ v switches to set VTBI.
7. Press the **RUN/HOLD** switch twice to start infusion.

Programming

Changing the infusion rate

1. Press the **RUN/HOLD** switch to place the pump on hold.
2. Press the **RATE** switch.
3. Use the ∧∨ switches to set the new rate.
4. Restart the pump at the new rate by pressing the **RUN/HOLD** switch.

Clearing the total Volume Infused

1. Press the **RUN/HOLD** switch to place the pump on hold.
2. Press and hold the **TOT VOL INF** switch and the ∨ switch directly above simultaneously for 2 seconds until display shows **000.0**.
3. Resume infusion by pressing the **RUN/HOLD** switch.

Changing the Volume To Be Infused

1. Press the **RUN/HOLD** switch to place the pump on hold.
2. Press the **VOL TO BE INF** switch.
3. Set new volume by pressing the ∧∨ switches. **OFF** can also be selected when a flow sensor is in use, see Notes below.
4. Restart the pump by pressing the **RUN/HOLD** switch.

Notes:

1) Without a flow sensor in use, a VTBI value *must* be entered, otherwise, the pump will be unable to operate.
2) With a flow sensor in use, a VTBI value isn't required and **OFF** can be selected if required.

Adjusting the maximum pressure limit (Occlusion pressure alarm level)

1. Simultaneously press and hold the **LIMIT PRES** switch whilst using the ∧∨ switches to adjust the pressure limit.
2. Release the **LIMIT PRES** switch.

Note: Pressure value will be displayed in **mmHg** or in **cmH20** depending on unit selected. See 'Pressure Unit Selector'.

Reading the pressure

1. Press and hold the **READ PRES** switch. Wait at least 10 seconds to allow reading to stabilize.

   Note: Pressure value will be displayed in **mmHg** or in **cmH20** depending on unit selected. See 'Pressure Unit Selector'.

Selecting alternating display of total volume infused

1. Press and release the **TOT VOL INF** switch three times within 2 seconds while the pump is infusing or on hold.
   - On Model 572, the display will alternate between primary or secondary infusion and total volume infused.
   - On Model 571, the display will continuously show the total volume infused.

Selecting alternating display of infusion pressure

1. Press and release the **READ PRES** switch three times within 2 seconds while the pump is infusing or on hold.
   - On Model 572, the display will alternate between primary or secondary infusion and infusion pressure.
   - On Model 571, the display will continuously show the infusion pressure.

Operating on Battery Power

The pump operates on battery power when it is disconnected from the AC power. The battery power indicator, the Information and Numeric Displays will flash whenever the pump is on battery power. In the event of a power failure, the pump will automatically continue to operate on battery power.

Two alarms indicate the condition of the pump's battery:

- **LOW BATT** alternating with the selected volume or pressure status. This indicates that approximately 30 minutes of operating time remains on battery power
- **LOW BATT** (constant). This indicates that the battery is discharged. Connect the pump to an AC power supply to recharge the battery.

Note: The pump's battery is designed for limited duration use. Wherever possible, the pump should be used connected to an AC power supply. If the pump is to be taken out of service for an extended period, it is good practice to charge the battery periodically to ensure full capacity.

Secondary Infusion (Model 572)

Introduction

This mode of operation supports automatic secondary infusions ("piggybacking") in the same pump channel. When the secondary VTBI reaches zero, a transition tone will sound and the primary settings will automatically take effect. Secondary mode can be used where a second, independent VTBI is required, and also when an automatic rate change is required.

When the pump is programmed and delivering in the secondary mode, the primary infusion is temporarily stopped and fluid is drawn from the secondary (higher) container. Delivery from the primary container resumes when the fluid level in the secondary line is level with the fluid in the primary container.

Notes:

1) The primary fluid container must hang lower than the secondary fluid container to allow the secondary infusion to run.
2) On completion of the secondary infusion the pump will automatically return to primary infusion.

Starting the Pump with Secondary Infusion

1. Load the primed set. See 'Loading the IV Infusion Set' earlier in this chapter for instructions.
2. Prepare the secondary infusion using a secondary solution container and the IVAC® "52" Series back check valve set; lower the primary container. See Figure 1-3 below.
   - Prime the secondary IV infusion set in accordance with the set *Directions for Use*
   - Attach a secondary IV infusion set to the upper Y-site of the primary IV infusion set
3. Press the **ON/OFF** switch to power on the pump. Pump always starts up in PRIMARY mode.
4. Use the ∧∨ switches to set the primary rate.
5. Press **VOL TO BE INF** if required.
6. Set primary VTBI if required.
7. Press the **SEC** switch to place the pump into SECONDARY mode. The pump will sound a four beep verification tone.
8. Use the ∧∨ switches to set the secondary rate.
9. Press the **VOL TO BE INF** switch.
10. Set secondary VTBI by using the ∧∨ switches.
11. Press **RUN/HOLD** to start secondary infusion.

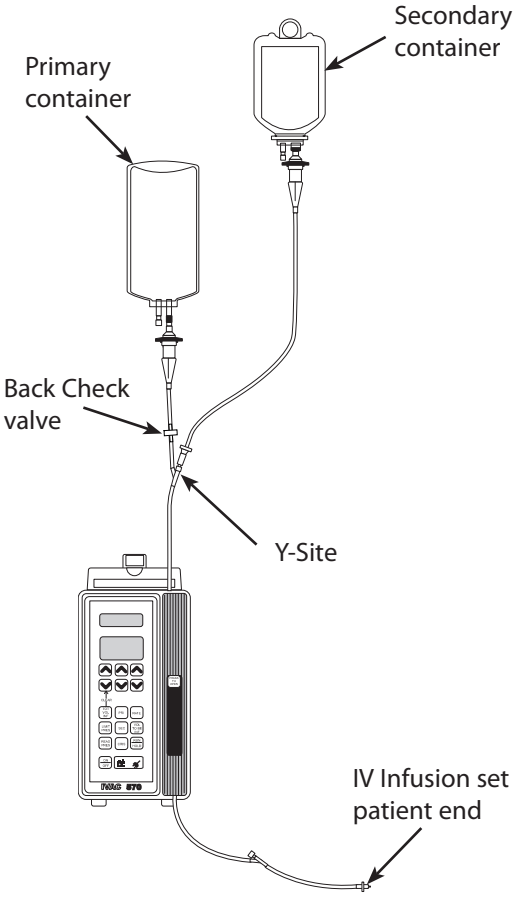


Figure 1-3
Secondary Infusion Set Up

WARNING:
- **Secondary infusion applications using a back check valve set must have a VTBI setting equal to the volume in the secondary container; this will require consideration of such variables as factory overfill, medication additions, priming volume, etc.**
- **Underestimating the volume will cause remaining secondary solution to be infused at the primary rate; overestimating will result in primary solution being infused at the secondary rate.**

When using a flow sensor it *must* be positioned on the primary IV infusion set (as shown in Figure 1-4). Correct placement of a flow sensor is essential for proper operation.

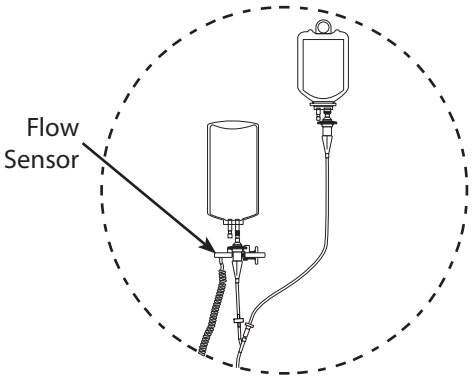


Figure 1-4
Secondary Infusion Set Up with Flow Sensor

Secondary Infusion (Model 572) continued

Additional Programming during Secondary Infusion

Verifying a value in one mode while operating in another

1. Press and release the appropriate (current) mode switch. For example, **SEC**.
2. Within two seconds press the switch representing the information to be displayed. For example, **PRI**.

Changing the infusion manually to primary mode

1. Press the **RUN/HOLD** switch to set pump on hold.
2. Press the **PRI** switch; pump sounds a three beep verification tone and goes into PRIMARY mode.

Flow Sensor

A flow sensor (part number 180) is used to detect an empty solution container. It is connected to the drip chamber and when a drop is detected in the drip chamber an illuminated ("0") appears in the Information Display.

When not in use, the flow sensor can be stored on the pump handle.

Pole Clamp Accessories

The following pole clamp accessories allow the pump to be mounted on conventional IV poles:

- Universal Pole Adapter (part number 6767)
- Pole Adapter (part number 5767A)*
- Pole Clamp Accessory (part number BC100A)*

* must be used in conjunction with each other.

Refer to Chapter 6, 'Spare Parts Replacement Procedures' for assembly information.

Chapter 2

Configuration & Calibration

In this chapter

Self-Test Mode	**14**
Mode Select Jumper	**15**
Configuration Settings	**15**
Selecting Pressure Units	**17**
Calibration Procedures	**17**

Self-Test Mode

Self-test mode is used to access a number of configuration and test routines which are designed to test and verify many of the pump functions, defaults and calibrations without requiring internal inspection. Configuration settings are also accessed via self-test mode.

Each test is accessed by selecting a Test ID number as shown in the table below.

Test ID	Description
001	Software Revision Display
002	Configuration Status Display
003	Flash Display Test
004	Segment Display Test
005	Sequence Display Test
006	EEPROM Test and Data Display
007	A/D Channels Test
008	Rate Calibration Display/Set
009 *	Configuration Rate Display/Set
010	Maximum Rate Display/Set
011 *	VTBI Configuration Display/Set
012	Pressure Display
013	Pressure Calibration Set
014	Maximum Occlusion Pressure Limit Display/Set
015	Default Occlusion Pressure Limit Display.Set
016	Alarm History Display/Clear
017	Switch Test
018	AC Power Run Time Display/Reset
019	Battery Run Time Display/Reset
020	Secondary Mode Completion Tone Display/Set
021	Air-In-Line Test
022	I/O Port Test
023	Language Display/Set
024	CIM ID Display/Set
025	Alarm Tone Display/Set
026*	AIL Alarm Threshold Display/Set
027	System Vacuum Display
028	Enter Operational Setup Mode
029	Burn-In Test
030	Not used
031*	Infusion Mode Configuration Display/Set

* A mode select jumper (part number 132350) must be used to change settings, see 'Mode Select Jumper' for further details.

Entering Self-Test Mode

1. Press the **RUN/HOLD** and **ON/OFF** switches simultaneously until the display turns on. Initially, the current software revision level is displayed.
2. Press the **RUN/HOLD** switch. The Information Display will read: **TEST ID** and the Numeric Display will read: **002** which means the pump is ready to start test **002**.

   Note: The display may bypass the display of the software revision level and advance directly to **TEST ID 002**, depending on how long the **RUN/HOLD** switch is held down.
3. Use the ∧ ∨ switches to select the Test ID required.

The three columns of ∧ ∨ switches allow faster/slower increments:
Left = 100's
Centre = 10's
Right = Units

Test Execution

1. After selecting the Test ID number (see above), press the **RUN/HOLD** switch to start the test.
2. To exit a test, press the **RUN/HOLD** switch.

Exiting Self-Test Mode

Self-test mode can be exited at any time:

- Turn the pump off by pressing the **ON/OFF** switch

  OR
- Select test **028** then press the **RUN/HOLD** switch to enter the start-up mode of operation

Mode Select Jumper

In order to perform certain tests and to change any pump settings, a mode select jumper must be installed.

Procedure:

1. With the pump off, remove the test connector cover from the back of the rear case.
2. Connect the mode select jumper (part number 132350) to the test connector, orientating the jumper so that CR1 is at the top.
3. Place the pump in self-test mode then select and carry out the test(s) as required.
4. When the test is complete, switch the pump off and remove the mode select jumper from the test connector.
5. Refit the test connector cover.

Configuration Settings

Enter Self-Test mode. See 'Entering Self-Test Mode' in previous section for instructions.

Note: For default settings refer to Appendix C 'Configured Options'.

Test ID	Setting	Action/Data Displayed
009	Rate Configuration **RATE CFG**	Display and/or set the current rate range. **STANDARD** = rate range of 001 to 999 ml/h **ALL RATE** = rate range of 0.1 to 999.9 ml/h. Note: Use this setting where fractional flow rates are required. To change the setting: • Install the mode select jumper. See 'Mode Select Jumper'. • Press the **CRIS** (lower hidden switch on Model 571) and **VOL TO BE INF** switches together and wait for a click. • Press the ∧ unit (right column) switch to select **STANDARD** or the ∨ unit switch to select **ALL RATE**.
010	Maximum Rate **MAX RATE**	Display and/or set the maximum infusion rate. **999** = set to STANDARD rate configuration (ml/h). This rate cannot be changed. **0.1 and 999.9** = set to ALL RATE configuration (ml/h). Note: Rate configuration is set in Test **009**. To change the maximum rate setting (for ALL RATE configuration): • Press and hold the **PRI** (upper hidden switch on Model 571) while using the ∧ ∨ switches to adjust the value.
011	VTBI Configuration **VTBI CFG**	Display and/or set the Volume To Be Infused (VTBI) limit. VTBI limit ranges are: MACRO = 1 to 9999 ml, MICRO = 0.1 to 999.9 ml. If set to ALL RATE configuration (see Test 009), **VTBI CFG** can be set to **MACRO** or **MICRO**. If set to STANDARD rate configuration, **VTBI CFG** is set to **MACRO** and is not adjustable. To change the VTBI limit (for ALL RATE configuration): • Install the mode select jumper. See 'Mode Select Jumper'. • Press the **CRIS** (lower hidden switch on Model 571) and **VOL TO BE INF** switches together and wait for a click. • Press the ∧ unit switch to select **MACRO** or the ∨ unit switch to select **MICRO**.
014	Maximum Occlusion Pressure **MAXIMUM**	Display and/or set the maximum occlusion pressure limit. Pressure values are displayed in **MMHG** or **CMH_20** depending on the pressure units selected. See 'Selecting Pressure Units' for further information. This pressure limit setting determines the upper limit of the pumps' variable pressure range thereby fixing the upper limit when the **LIMIT PRES** switch is used during normal operation. To change the setting: • Press and hold the **PRI** (upper hidden switch on Model 571) while using the ∧ ∨ switches to adjust the value. • Press the **RUN/HOLD** switch to save the new value.

Configuration Settings *(continued)*

Test ID	Setting	Action/Data Displayed
015	Default Occlusion Pressure **DEFAULT**	Display and/or set the default pressure limit. Pressure values are displayed in **MMHG** or **CMH_20** depending on the pressure units selected. See 'Selecting Pressure Units' for further information. This setting determines the occlusion pressure limit at power up. To change the setting: • Press and hold the **PRI** (upper hidden switch on Model 571) while using the ∧ ∨ switches to adjust the value. • Press the **RUN/HOLD** switch to save the new value.
020	Secondary Mode Completion Tone (Model 572 only)	Display and/or set the audible tone that sounds when the SECONDARY infusion finishes and switches to PRIMARY infusion. **1 CLICK** = one-click tone **4 BEEPS** = four-beeps tone To change the setting: • Press the ∧ unit switch to select **4 BEEPS** or the ∨ unit switch to select **1 CLICK**.
023	Language	Display and/or set the language to be displayed. Languages are **ENGLISH, DUTCH, FRENCH, GERMAN, ITALIAN, SPANISH** or **SWEDISH**. To change this setting: • Press the ∧ ∨ unit switches to scroll through list and select language.
024	CIM ID **CIM ID**	Setting is not in use. **OFF** = CIM not in use, **001** to **999** = CIM ID number Important: Ensure the setting is **OFF**. To change setting to **OFF**: • Press and hold the **VOL TO BE INF** switch while using the ∧ ∨ switches to select **OFF**. • Press the **RUN/HOLD** switch to save the new setting.
025	Alarm Tone	Display and/or select the alarm tone volume level. Approximate decibel volumes are: **HI TONE = 90 db** **MED TONE = 80 db** **LOW TONE = 70 db** To change the setting: • Press the ∧ unit switch to select alarm tone. WARNING: Take any necessary precautions against prolonged exposure to the **HI TONE** alarm as this may result in hearing damage.
026	AIL Alarm Threshold **UL AIR**	Display and/or set the air bubble length maximum value. This value is the nominal air bubble threshold in microlitres used for air-in-line detection. Value must be between 50 and 150 microlitres. To change the setting: • Install the mode select jumper. See 'Mode Select Jumper'. • Press the **CRIS** (lower hidden switch on Model 571) and **VOL TO BE INF** switches together and wait for a click. • Press the ∧ ∨ switches to enter the value (in 10 µl increments).
031	Infusion Mode **INFM CFG**	Display and/or set the pump infusion mode. **PRI ONLY** = PRIMARY infusion mode only (Model 571). **SEC/CRIS** = PRIMARY and SECONDARY infusions modes. (Model 572). To change the setting: • Install the mode select jumper. See 'Mode Select Jumper'. • Press the **CRIS** (hidden switch on Model 571) and **VOL TO BE INF** switches together and wait for a click. Press the ∧ unit switch to select **PRI ONLY** or the ∨ unit switch to select **SEC/CRIS**. Note: Model 571 must be set to **PRI ONLY.**

Selecting Pressure Units

The pressure units can be configured to be displayed as millimetres of mercury (mmHg) or as centimeters of water (cmH_20).

To select the pressure units:

- Set the Pressure Unit Selector switch on the rear panel to the required position.

Pressure Unit Selector Switch

Calibration Procedures

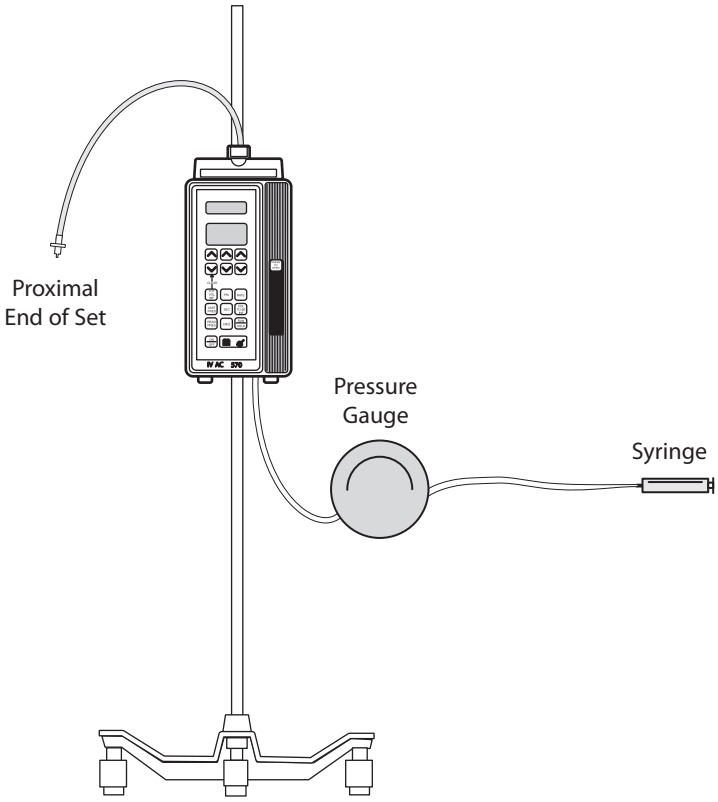
Vacuum System Calibration (Test 27)

Equipment required:

- 50ml syringe
- Pressure gauge
- "52" Series IV infusion set

Procedure:

1. Remove the battery cover from the pump to allow access to the Accessory Interface Board. See Chapter 6, 'Spare Parts Procedures' for instructions.
2. Prepare a modified IV infusion set as follows:
   - Completely remove the clear membrane cover from the white pressure sensing disc. Ensure no membrane remains as this could compromise the integrity of the vacuum
   - Attach the air-filled IV infusion set to the syringe. Use the luer fitting on the distal end of the set or cut approximately 1 inch (2.5 cm) off the distal end and press the tubing firmly into the tip of the syringe. Ensure a good seal is formed between the two devices
   - Splice a T-fitting into the IV infusion set tubing approximately 1 foot (30 cm) up from the syringe attachment. Connect the pressure gauge to the T-fitting port
   - Push the syringe plunger in until it stops
3. Load the modified IV infusion set into the pump and close the door. Ensure that the set tubing is not kinked.



4. Enter self-test mode and select test **027**. See 'Entering Self-Test Mode' for instructions.
5. Press the **RUN/HOLD** switch to enter the Vacuum Display mode and display **VAC MMHG**.
6. Pull the syringe plunger out until the pressure gauge reads **-95** mmHg and immediately clamp off tubing below the pump to hold the vacuum stable.
7. Adjust the vacuum detect potentiometer **R45** on the Accessory Interface Board until the numeric display on the pump reads **-95** ± 5 mmHg**.**

   Note: **R45** is the upper potentiometer on the Accessory Interface Board.
8. Perform the 'Vacuum Retention Verification' procedure as detailed in Chapter 3, 'Routine Maintenance'.

Do *not* adjust the lower potentiometer, R4, this is pre-adjusted during manufacture.

Calibration Procedures *(continued)*

Dry Set Pressure Calibration (Test 13)

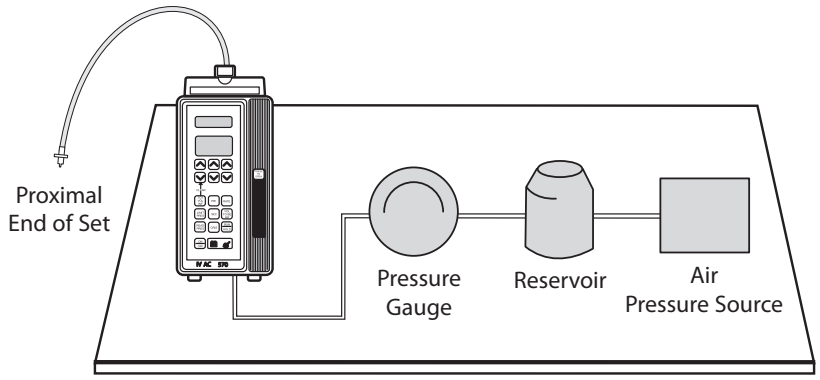
Equipment required:

- Test jumper cable (142109)
- Pressure gauge
- "52" Series IV infusion set (dry set)

Procedure:

1. Remove the chassis from the body. See Chapter 6, 'Spare Parts Procedures' for instructions.
2. Attach the jumper of the test jumper cable between connector J7 on the Logic Board and connector P7 on the Accessory Interface Board.
3. Connect the battery pack to the battery connector.
4. Set up equipment as shown below.

   Note: Set the pressure unit selector switch (on the back panel of the pump) to the same units as the air pressure source.



5. Enter self-test mode, press the **RUN/HOLD** switch and select test **12**. Press the **RUN/HOLD** switch again to display the pressure **MMHG** (or **CMH_20**).

   Ensure the pump is connected to the AC power supply for approximately 30 minutes before continuing with this calibration.
6. Enter self-test mode, press the **RUN/HOLD** switch and select test **13.** Press the **RUN/HOLD** switch again to display **PRES CAL**.
7. With the door open and no set loaded, adjust the **zero** potentiometer (R20 on the Analog Board) so the pump reads **000** ±1 mmHg (or **000** ±1.4 cmH_20).
8. Install an IV infusion set, close the door and apply a test pressure of 000 mmHg (000 cmH_2O) to the distal end of the set. Record the reading displayed as the PI offset value.
9. Apply a test pressure until the meter reads **400** mmHg (544 cmH_2O) and adjust the **span** potentiometer (R23 on the Analog Board) so the pump reads **400** mmHg ±2 (544 cmH_20 ±10) *plus* the offset value, PI, recorded in the previous Step.
10. Return the test pressure to 000 mmHg (000 cmH_2O), bleed off any air from the IV infusion set then remove the IV infusion set.
    Note: If the set is removed when still under pressure may result in damage to the pressure sensing disc film.
11. Leave the door open and reverify that the pump reads **000** ±1 mmHg (000 ±1.4 cmH_2O). If not, repeat the procedure from Step 7, until no further adjustment of the **zero** and **span** potentiometers is required.

Calibration Procedures *(continued)*

Dry Set Pressure Calibration (Test 13) *continued*

12. Press the ^ unit and **RATE** switches simultaneously for a minimum of one second to set the 000 mmHg (000 cmH_2O) calibration point.
13. Reload the IV infusion set and apply test pressure until the meter reads **400** mmHg (544 cmH_2O). When the pressure reading is stable, press the **TOT VOL INF** and the ^ 100 switches simultaneously for a minimum of one second to set the 400 mmHg (544 cmH_2O) calibration point.

Both Steps 12 and 13 must be performed to correctly set the calibration parameters. Performing only one step will result in the message RECONFIG REQD when the pump returns to operation.

14. Press the **RUN/HOLD** switch to return to test **13** and turn the pump OFF. Remove the IV infusion set (first bleeding off any pressure).
15. Disconnect the battery pack from the battery connector.
16. Remove the test jumper cable and reassemble the pump.
17. Perform the 'Dry Set Pressure Verification' procedure as detailed in Chapter 3, 'Routine Maintenance'.

Calibration Procedures *(continued)*

Rate Accuracy Calibration (Test 8)

There are two types of rate accuracy associated with the pump, these are System Rate Accuracy and Pump Rate Accuracy.

System Rate Accuracy is the rate accuracy of the pump when used with a standard "52" Series infusion set. Due to slight variations in between sets, the system accuracy of the pump is ± 5%. Pump Rate Accuracy is the absolute rate accuracy of an individual pump which can only be determined with the use of a characterised set.

The following procedure describes how to calibrate the Pump Rate Accuracy. For instructions on how to verify Pump Rate Accuracy, see 'Rate Accuracy Verification' in Chapter 3, 'Routine Maintenance'.

Characterised Sets (part number 191806)

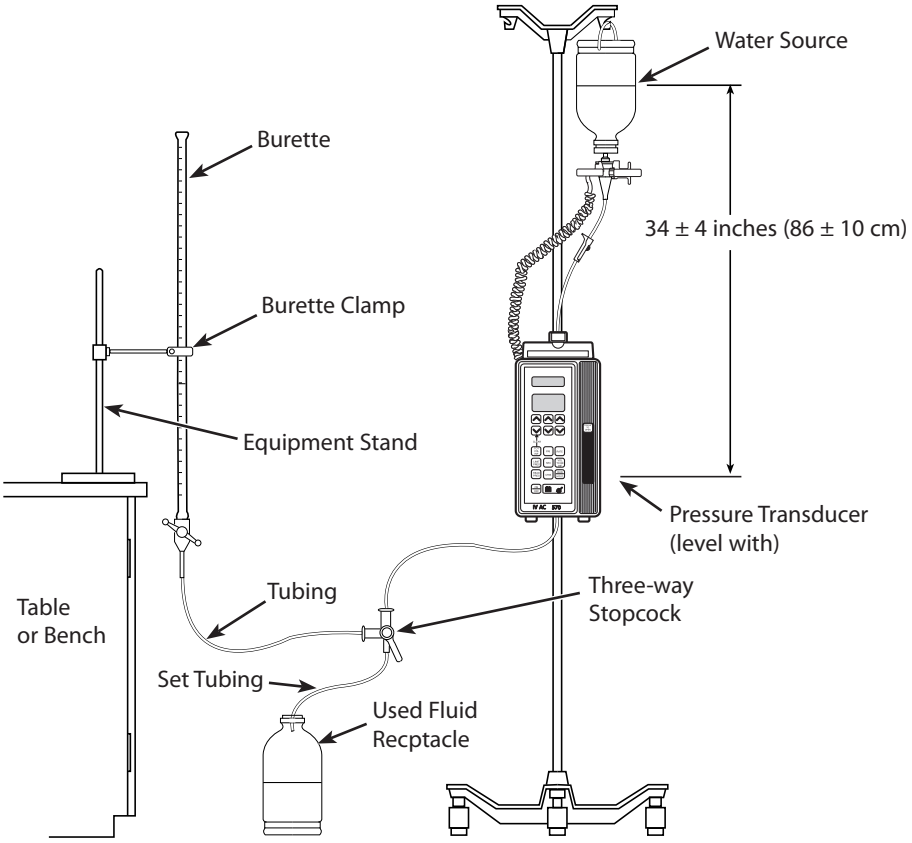
- **Must be used for rate accuracy calibration**
- **Sets are labeled with a serial number, a nominal volume and an expiry date (180 days from the date the set was characterised)**
- **Handle sets with care at all times. Sets must not be pressurised. Prior to loading or removing from the pump, manually open the auto-pinch-off mechanism. Do not stretch the set excessively**
- **Record the number of times each set is used in a log book. A set must not be used for more than 20 rate runs.**

Equipment required:

- Characterized set (191806)
- Stopwatch
- Class A burette (50 ml) with 0.1 ml graduations

Preparation:

1. Set up the equipment as shown.
   - The vertical distance from the fluid level of the container to the pump pressure transducer should be 34 ±4 inches
   - The burette zero line should be within ± 2 inches from the pump pressure transducer. Verify that the inside of the wall is free of droplets
   - Ensure fittings are secure and there is no leakage through the 3-way stopcock
   - Ensure that the air has been purged from the characterised set and all equipment
2. Close the set roller clamp.
3. Plug the pump into the AC mains and turn the pump **ON**.



Calibration Procedures *(continued)*

Procedure:

1. Enter self-test mode, press the **RUN/HOLD** switch and select test **8**. Press the **RUN/HOLD** switch again to display **CAL RATE**.
2. Press and hold the **PRI** switch then use the ∧∨ switches to enter an initial rate calibration of **37**. Press the **ON/OFF** switch to turn the pump off.

   Note: Ensure a characterised set is loaded and the burette is free of droplets.
3. Turn the pump **ON** and set the pump to Primary rate = **800** ml/h, VTBI = **OFF,** TOT VOL INF = **000.0** (or, if not using a flow sensor, set the pump to Primary rate = **800** ml/h, VTBI = **100** ml, TOT VOL INF = **000.0**).
4. Press the **RUN/HOLD** switch to start the pump and simultaneously start the stopwatch. Allow the pump to run for 3 minutes (180 seconds) then press the **RUN/HOLD** switch to put the pump on hold.
5. Verify that the volume in the burette is 40.0 ± 0.4 ml. If not, repeat the test.

   If the percentage of error is greater than ± 1%, use the following formula to determine the new **CAL RATE** number:

Formula to determine new CAL RATE number

Final CAL RATE number =

$$\left[\frac{\text{(actual volume)}}{\text{expected volume}} - 1 \right) \times 200 \Bigg] + \text{initial number}$$

Example:

actual burette volume	= 40.8 ml
expected volume	= 40.0 ml
initial CAL RATE number	= 37

Final CAL RATE number =

$$\left[\frac{(40.8)}{40.0} - 1 \right) \times 200 \Bigg] + 37 = \mathbf{41}$$

Set the CAL RATE number to 41 in Test **8** while pressing the **PRI** switch.

6. Repeat the above calibration procedure until the actual volume is within ±1% of the expected volume indicated on the characterised IV infusion set.

Chapter 3

Routine Maintenance

In this chapter

Routine Maintenance	23
Self-Test Functions	23
Upgrading Software	26
Vacuum Retention Verification (Test 27)	26
Dry Set Pressure Verification (Test 12)	27
Functionality Checks	28
Auto-Pinch-Off (APO) Test	29
Mechanism Leak Test	30
Rate Accuracy Verification	32
Downstream Pressure Occlusion Test	33
Physical Inspection and Clean	34
Inspecting the Mechanism	35
Flow Sensor Check (where flow sensor is in use)	35
Performance Verification Procedure	36

Routine Maintenance

For routine maintenance, the following tests and procedures should be performed in addition to the tasks described in the section 'Physical Inspection and Clean'.

Refer to the relevant *DFU* for the recommended routine maintenance period.

Self-Test Functions

The self-test functions are a series of test routines which are designed to test and verify many of the pump functions and defaults without requiring internal inspection. These tests are accessed by entering Self-Test mode and selecting a Test ID number as shown in the table below.

1. Enter Self-Test mode. See 'Entering Self-Test Mode' in Chapter 2 for instructions.
2. Proceed through the series of tests, referring to the table below for details of each test.

   Note: For details of other tests such as the configurable options and calibration settings, see Chapter 2, 'Configuration & Calibration'.

Test ID	Test	Action/Description
001	Software Revision	Displays the current software revision level, e.g. **REV 3.01**.
002	Configuration Status	Verifies whether or not the configuration data is valid. **CONFIG/VALID** = configuration data is valid OR,, where not valid, a message indicates which configuration is required to be set: **SET RATE CAL** = see Test ID 008 **SET RATE CONFIG** = see Test ID 009 **SET RATE MAX** = see Test ID 010 **SET VTBI CONFIG** = see Test ID 011 **SET PRES CAL** = see Test ID 013 **SET PRES MAX** = see Test ID 014 **SET PRES DEFAULT** = see Test ID 015 **SET AIR LIMIT** = see Test ID 026 **SET INF MODE CONFIG** = see Test ID 031
003	Display Flash Test	Verify that the segments of both Displays light and the battery indicator flashes as follows: Information Display: all positions show ************ alternating with **00000000**. Numeric Display: all positions show **8888** alternating with **0000**. The two decimal points also flash. Battery indicator: flashes alternately on and off.
004	Display Segment Test	Verify that both Displays show various characters and the battery indicator flashes as follows: Information Display: repeatedly cycles through the 64-character set (**A to Z, 0 to 9 and ASCII characters**). All positions must show the same character at the same time. Numeric Display: repeatedly cycles through numbers **0 to 9**. All positions must show the same character at the same time. Battery indicator: flashes alternately on and off.
005	Display Sequence Test	Verify that both Displays show numbers, one position at a time (and the battery indicator flashes) as follows: Information Display: numbers **0 to 7** appear sequentially, left to right. Numeric Display: numbers **0 to 3** appear sequentially, left to right. Battery indicator: flashes alternately on and off.
006	EEPROM Test and Display Data	Verify that both Displays cycle through numeric sequences (and the battery indicator flashes) as follows: Information Display: ignore this 128-byte location reading. Numeric Display: counts from **001** through **128**.

Self-Test Functions *(continued)*

Test ID	Test	Action/Description
007	A/D Converter Test	Verify the eight A/D channels (0 through 7) as follows, using the ∧ and ∨ switches to select each channel. Note: The Information Display shows the Channel number being tested (0 through 7) and the Numeric Display shows a value representing the analog input to the A/D convertor. Channel 0 = Flow Sensor Test Information Display: All positions show 0's, **00000000.** Numeric Display: Value must be greater than **195** (no obstruction in the light path), or less than **185** (light path is obstructed). Channel 1 = Drop Reference Information Display: All positions show 1's, **11111111.** Numeric Display: Value must read **210 ± 8**. Channel 2 = Battery Monitor • Unplug the pump from AC power. Information Display: All positions show 2's, **22222222.** Numeric Display: New battery reading must be greater than or equal to **140**. A reading of less than **140** indicates a discharged or bad battery. • Plug the pump into AC power. Channel 3 = Pressure Information Display: All positions show 3's, **33333333.** Numeric Display: value between **0** and **500**. Channel 4 = Flow Sensor Detect Information Display: All positions show 4's, **44444444.** Numeric Display: Value less than **20** (flow sensor not plugged in) or more than **80** (flow sensor plugged in). Channel 5 = Vacuum Detect Signal Information Display: All positions show 5's, **55555555.** Numeric Display: Value between **110** and **277** (with set installed). Channel 6 = Not used. Ignore reading. Channel 7 = Not used. Ignore reading.
012	Read Pressure	Verify the pressure level reading sensed by pressure transducer. Note: To ensure a valid reading, the pump should be powered on for at least 30 minutes prior to this test. Information Display: **CMH20** or **MMHG** (per pressure unit selection switch position on back panel). Numeric Display: Without set installed, shows value between **-28** and **+14** cmH_20 or between **-20** and **+10** mmHg.
016	Read Alarm History	Read the last 16 alarm or error messages (alarm stack). The most recent alarm or error is always displayed first. Information Display: All positions show *'s, ******** are displayed initially, followed by repeated cycle of the last 16 alarm messages. Numeric Display: Blank To clear the alarm stack: • Press and hold the **READ PRES** switch and the ∧ 100 switch for at least 2 seconds, until the display shows ********.

Self-Test Functions *(continued)*

<table>
<tr><th>Test ID</th><th>Test</th><th>Action/Description</th></tr>
<tr><td>017</td><td>Switch Test</td><td>Information Display: Initially shows SWCH TEST. Press each switch and verify the corresponding code is displayed:
<table>
<tr><th>Switch:</th><th>Display code:</th><th>Switch:</th><th>Display code:</th></tr>
<tr><td>TOT VOL INF
PRI
RATE
LIMIT PRES
SEC
VTBI
READ PRES</td><td>TL V INF
PRI
RATE
LIMT PRS
SEC
VTBI
READ PRES</td><td>CRIS
∧ 100
∨ 100
∧ 10
∨ 10
∧ Unit
∨ Unit</td><td>CRIS
UP 100
DN 100
UP 10
DN 10
UP 1
DN 1</td></tr>
</table>
Notes:
1) The ON/OFF switch does not have a code.
2) The Numeric Display remains blank.</td></tr>
<tr><td>018</td><td>Read Hours on AC</td><td>Read/clear the total number of hours that the pump has run on AC power.
Information Display: AC HRS
Numeric Display: Number of hours on AC power.
To reset the total AC power hours to 0000:
• Press and hold the READ PRES switch and the ∧ 10 switch for at least 2 seconds.</td></tr>
<tr><td>019</td><td>Read Hours on Battery</td><td>Read/clear the total number of hours that the pump has run on battery power.
Information Display: BATT HRS
Numeric Display: Number of hours on battery power.
To reset the total AC battery hours to 0000:
• Press and hold the READ PRES switch and the ∧ unit switch for at least 2 seconds.</td></tr>
<tr><td>021</td><td>Air-In-Line Test</td><td>Verify air-in-line sensor operation. To run test:
• Load an air-filled or fluid-filled IV infusion set.
Information Display: 00000000 = fluid detected in IV infusion set and door is closed.
10000000 = air detected in IV infusion set or door is open.
Numeric Display: UAIL</td></tr>
<tr><td>022</td><td>I/O Port Test</td><td>Read data on the various input ports. Press the ∧ and ∨ switches to select each port.
Information Display: Shows the 8 input port data bits in binary format.
Numeric Display: Indicates which port is being examined:
000 = display port, Display U7. 008 = switch port, Display U5. 016 = Logic U20. 048 = A/D end of conversion, U22. 064 = Logic U21. 080 and 081 = parallel I/F ports. 096, 097, 098 and 099 = serial I/F ports. 128 = timer of Logic U14. 129 = Logic U23. 130 = Logic U24.
Key troubleshooting tests:
• Port 016
bit 0 = rotation sensor 1
bit 1 = rotation sensor 2
bit 2 = set sensor
bit 3 = air-in-line sensor
• Port 064
bit 7 = door sensor</td></tr>
<tr><td>027</td><td>System Vacuum Test</td><td>Read the vacuum level being applied by the vacuum system when an IV infusion set is loaded and the door is closed.
Information Display: VAC MMHG
Numeric Display: Current vacuum value that is generated to hold the pressure sensing disc in place.
To run the test, following the instructions in 'Vacuum Retention Verification' later in this chapter.</td></tr>
</table>

Self-Test Functions *(continued)*

Test ID	Test	Action/Description
028	Enter Operational Setup Mode	The pump exits self-test mode and starts operational set up mode.
029	Burn-in Test	Allows pump to run (burn-in) without setting up an IV solution bag, fluid and drain. Warning: This test must *only* be run in a workshop environment for verification that internal failures have been corrected. Full performance verification testing must then be carried out. To run test: Load an air-filled IV infusion set and close the door. Enter self-test mode, select test **029**, press the **RUN/HOLD** switch then, within two seconds, press and hold the **PRI** and **CRIS** switches together. Pump will start running at maximum rate and rate can be changed by pressing the **RATE** switch and using the ∧ and ∨ switches.

Upgrading Software

The latest version of software available for Model 571/572 is V3.01. Perform upgrades by acquiring the software upgrade kits specified in the spare parts listing.

Equipment required:

Software upgrade kit

Software Upgrade Kits Available

Pump Model	Part Number		Software Version
571/572	145071	KIT,UPGRD,REV 3.01,570 (EPROM only)	3.01
	145070	SERV ASSY,MEM,REV3.01,570(BOM) (includes EPROM fitting and removal instructions)	3.01

Vacuum Retention Verification (Test 27)

The pump's vacuum system can be tested and verified by performing the following Vacuum Leak Test.

Procedure:

1. Enter self-test mode and select test **27**. Press the **RUN/HOLD** switch to enter the Vacuum Display mode and display **VAC MMHG**.
2. Load an IV infusion set and close the door.
3. Verify that the numeric display shows a reading of **-250** or more negative.
4. Allow the reading to stabilise for 5 to 10 seconds, then record the value, for example, **-337**.
5. After 30 seconds, verify that the vacuum value has not decreased by more than 5, for example **-332**.

   If the pump fails this test:

   - Check the following things, replacing and repeating the test as necessary:
     - Face of the pressure transducer
     - Replace the test IV infusion set
     - Y-clip, door latch pin, door latch
     - Pressure transducer/vacuum assembly
   - Perform the 'Vacuum System Calibration' procedure, see Chapter 2. for instructions.

Dry Set Pressure Verification (Test 12)

When servicing the pump perform the following pressure calibration verification procedure.

Note: If the pump fails this test, perform the 'Dry Set Pressure Calibration' procedure. See Chapter 2. for instructions.

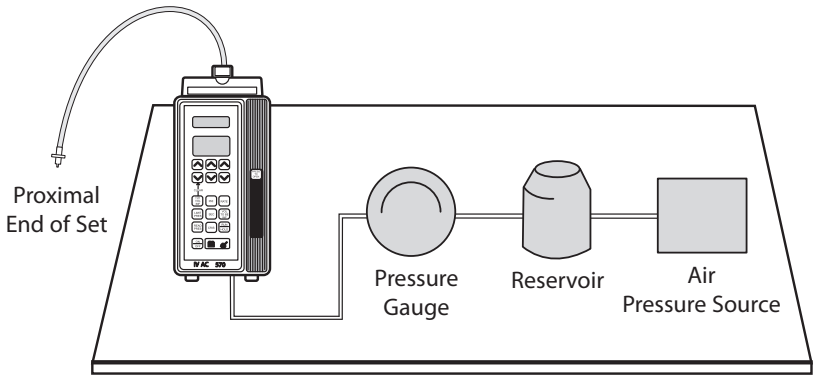
Procedure:

1. Connect the pump to the AC mains and set up the equipment as shown below..

   Note: Set the pressure unit selector switch (on the back panel of the pump) to **mmHg**.

2. Enter self-test mode, press the **RUN/HOLD** switch and select test **12**. Press the **RUN/HOLD** switch again to display the pressure **MMHG**.

   Allow the pump to warm up for approximately 30 minutes before continuing with this test.



3. Load an IV infusion set and close the door.
4. Apply a pressure of **000** mmHg and verify that the pump displays a reading of **-20** to **+10** mmHg.

When applying the 000 mmHg pressure, ensure the set has just been loaded. If necessary reload the IV infusion set.

5. Apply a pressure of **400** mmHg and verify that the pumps displays a reading of **367** to **423** mmHg.

- **Do not allow the applied test pressure to exceed the intended pressure value by more than 50 mmHg. If this occurs, reload the IV infusion set and repeat test**
- **The pressure read accuracy must be ±15 mmHg or ± 7%, whichever is greater**

Functionality Checks

Alarms

Alarm	Action
LOAD SET	Without an IV infusion set loaded, turn the pump ON, set rate to 125 ml/h then press the **RUN/HOLD** switch. Verify that the **LOAD SET** message is displayed.
DOOR	With the pump running, open the door. Verify that the pump stops, alarms and the message **DOOR** is displayed. Verify that the automatic pinch-off clamp has stopped the flow by checking that no drops are falling in the drip chamber.
AIL	Load a fluid-filled IV infusion set. Turn the pump ON, set rate to 125 ml/h then press the **RUN/HOLD** switch to start infusing. Tilt the drip chamber of the set to induce air bubbles into the IV infusion set. Verify that when the air bubble enters the pump, the pump alarms, stops and displays the message **AIR IN LINE**. Turn the pump **OFF** and remove the test loop. Load an empty, air-filled IV infusion set. Turn the pump ON then press the **RUN/HOLD** switch to start the pump. The pump should *not* run; verify that the **AIR IN LINE** message is displayed. If the pump *does* run, refer to Chapter 4, 'Troubleshooting'.
FLOW SENSOR	Block the light in the flow sensor (with a finger or other suitable object) to simulate a faulty flow sensor. Press the **RUN/HOLD** switch to resume infusing. After a short time, verify that the pump stops, alarms and the display message alternates between **FLOW** and **SENSOR**.
BOTTLE CLAMP **(with Flow Sensor)**	Press the **RUN/HOLD** switch to place the pump on hold. Hold the **VOL TO BE INF** switch and press the ﹀ unit switch until **OFF** is displayed. Press the **RUN/HOLD** switch to start the infusion. After approximately one minute, close the roller clamp. Verify that the pump stops running, the alarm tone sounds and the display message alternates between **BOTTLE** and **CLAMP**.
UPSTREAM OCCLUSION **(without Flow Sensor)**	Press the **RUN/HOLD** switch to place the pump on hold. Set VTBI to 60 ml by first pressing the **VOL TO BE INF** switch then the ﹀ switches. Set rate to 900 ml/h then press the **RUN/HOLD** switch to start infusing. After approximately one minute, close the roller clamp to create an upstream occlusion. Verify that the pump stops running, alarms and displays **UPSTREAM OCCLUSION**.
TIME OUT	Press the **RUN/HOLD** switch to place the pump on hold. Verify that the pump takes 2 minutes ±10 seconds to alarm after the last switch has been pressed. **TIME OUT** is displayed, and the rate is still shown.
PRESSURE LIMIT EXCEEDED **(DOWNSTREAM PRESSURE EXCEEDED)**	See 'Downstream Pressure Occlusion Test' procedure later in this chapter for instructions.

Battery Power Check and Operation Test

Before performing this test, it is recommended that the battery is charged to full capacity by connecting the pump to AC mains for a minimum of 16 hours.

1. Remove power cord from the AC power socket.
2. Press the **ON/OFF** switch to turn the pump on. Verify that the battery indicator flashes on and off.
3. Set rate to 499 ml/h then press the **RUN/HOLD** switch to start the pump. Verify that the pumping indicator bar appears on the Information Display and that it rotates rapidly.
4. (Optional) Verify that the pump continues to run for a minimum of 15 minutes without alarming **LOW BATT**.
5. Plug the power cord back in to AC power socket.

Flow Sensor Check

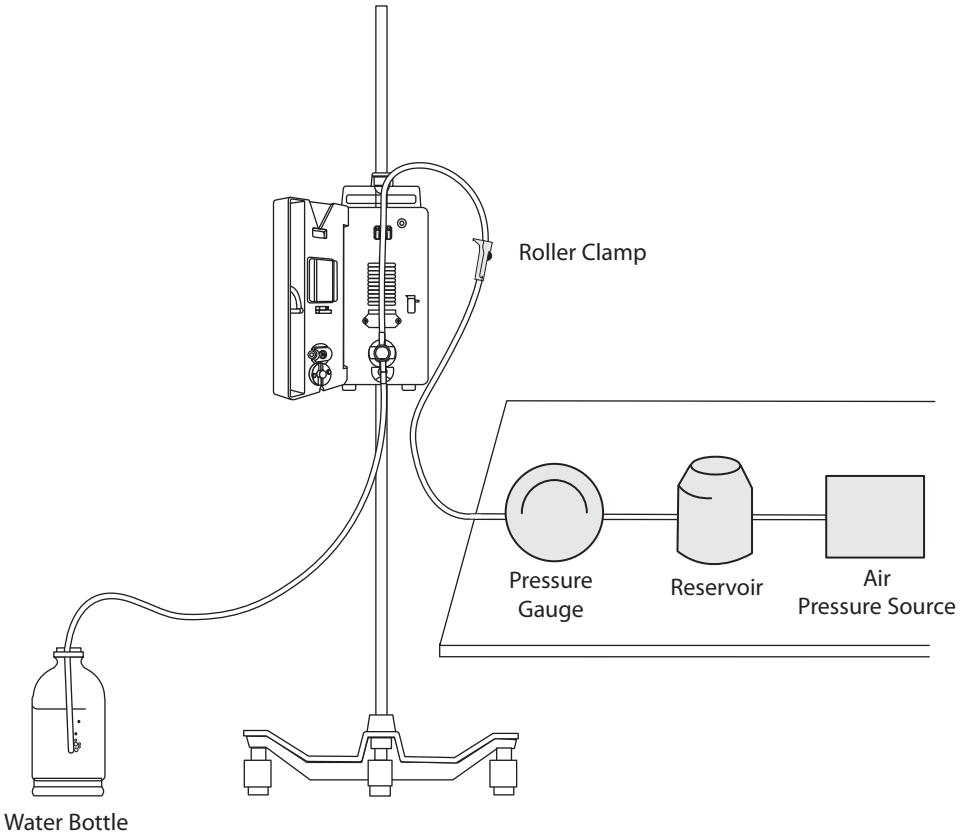
See 'Physical Inspection and Clean' for instructions.

Auto-Pinch-Off (APO) Test

Procedure:

1. Set up equipment as shown below.
2. Prepare a modified set as follows:
   - Take an IV infusion set and cut the tubing a couple of inches below the drip chamber, discarding the drip chamber.
   - Connect the air pressure source to the freshly cut proximal end of tubing.
   - Insert the distal end of the modified set into a container of water.
3. Close the roller clamp. Adjust the air pressure to 10 psi.
4. Load the modified IV infusion set. Close the door then open the roller clamp.
5. Open the door and verify that (after an initial spurt of bubbles) no further bubbles are seen coming from the distal end of the tubing into the water bottle.

   If bubbles continue, replace the auto-pinch mechanism. Refer to Chapter 6, 'Spare Parts Replacement Procedures' for instructions.



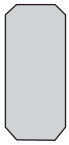
Mechanism Leak Test

When servicing the pump, the Mechanism Leak Test must be performed to verify the integrity of the pumping mechanism.
Misalignment of the pumping mechanism can result in the pressure plate and the mechanism's cam followers failing to pinch the IV infusion set tubing sufficiently, thereby allowing the pump to leak fluid at low rates or when stopped.

Procedure:

1. Prepare a special Pressure Test Set as follows:
   - Take an IV infusion set and cut the tubing a couple of inches below the drip chamber, discarding the drip chamber.
   - With a knife, carefully remove the membrane cover from the white pressure sensing disc, see Figure 3-2. Ensure no membrane (rough edges) remain—the surface of the pressure sensing disc should be as flat as possible after the membrane is removed.
   - Cut out a piece of mylar to match the shape and size shown below.

     Mylar Cap Shape

     Remove the adhesive backing and firmly press the mylar onto the surface of the pressure sensing disc so that it covers the vertical slot and is centered on the disc. See Figure 3-3
   - The distal end (bottom) end of the set may be cut to adapt it for connecting to the air pressure source.

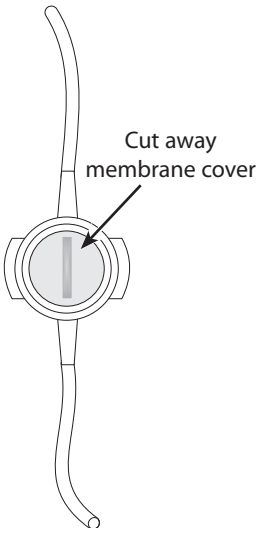


Figure 3-2

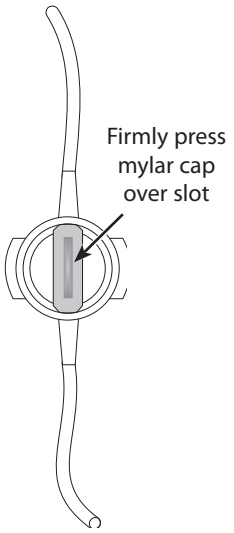
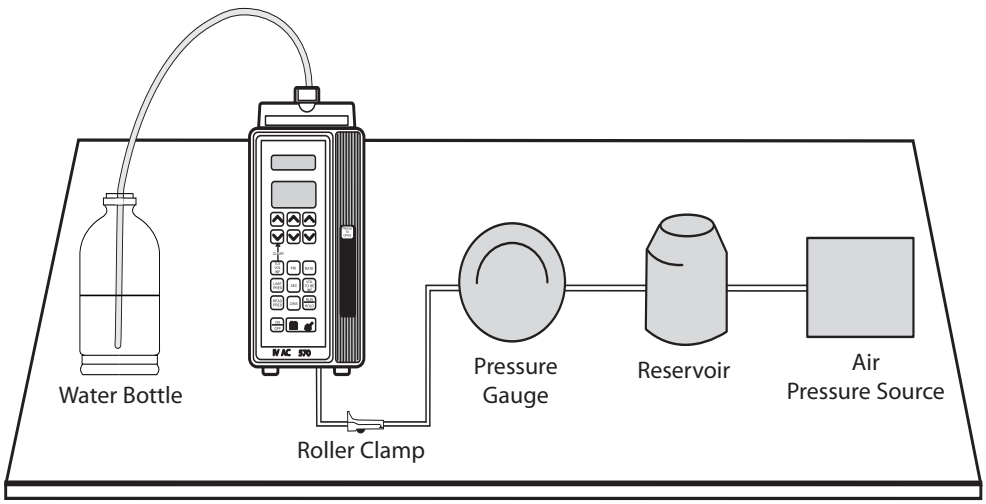


Figure 3-3

2. Load the special pressure test set, with 15.0 psi (775 mmHg) air pressure at the distal end, into the pump and close the door.

Change the special Pressure Test Set after 20 uses, or if signs of wear are visible on the silicone section or if any leak in the set is observed.

3. Run the top end of the pressure test set into the water bottle and below the water level (as shown below).
4. Open the pressure test roller clamp to pressurise the set.



Mechanism Leak Test *continued*

5. Verify that the pressure (that the transducer is seeing) is not greater than 300 mmHg when set is fully pressurised. To do this read the pressure using test **12** (Enter self-test mode, press the **RUN/HOLD** switch and select test **12).**

   Warning: A pressure reading greater than 499 mmHg may result in damage to the transducer.

   If a high pressure reading is noted, check the following:

   - The pressure sensing disc is positioned correctly.
   - The mylar cap is adhered tightly and correctly on the pressure sensing disc.
   - The height of the mylar cap matches the Myler Cap Shape shown above.

6. Connect the pump to the AC mains then turn the pump **ON**, entering self-test mode.
7. Press the **RUN/HOLD** switch and select the burn-in test **29,** then within two seconds, simultaneously press and hold the **PRI** switch and the **CRIS** switch.

   Verify that the pump is running at **999** (or **999.9** ml/h).
8. Set the rate to 20 ml/h (or 20.0 ml/h) by simultaneously pressing the **RATE** switch and the ^ v switches. Run the pump for at least one minute. Verify that no bubbles are visible in the water bottle.

   If air bubbles are visible in the water bottle, the pump fails the test.

   If the pump fails the test, verify set up and repeat the test as required, otherwise, return the pump to the manufacturer.
9. Turn the pump **OFF**.
10. Close the roller clamp *slowly*. Open the door to release any pressure trapped in the pressure test set and carefully remove the set from the pump.

    Note: Take care not to stretch the silicone segment of the set as correct segment length is critical to the mechanism's pinch-off capabilities.

Rate Accuracy Verification

There are two types of rate accuracy associated with the pump, these are System Rate Accuracy and Pump Rate Accuracy.

System Rate Accuracy is the rate accuracy of the pump when used with a standard "52" Series infusion set. Due to slight variations in between sets, the system accuracy of the pump is ± 5%. Pump Rate Accuracy is the absolute rate accuracy of an individual pump which can only be determined with the use of a characterised set.

The following procedure describes how to verify the Pump Rate Accuracy. For instructions on how to calibrate the Pump Rate Accuracy, see 'Rate Accuracy Calibration' procedure in Chapter 2.

Equipment required:

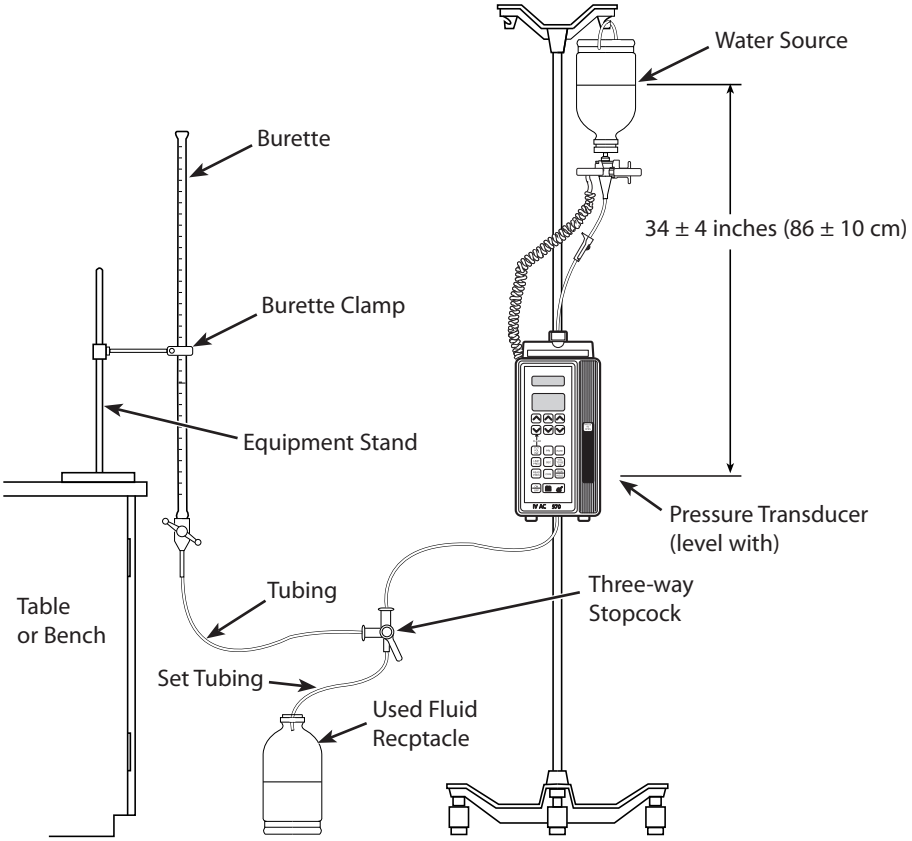
- Characterized set (191806)
- Stopwatch
- Class A burette (50 ml) with 0.1 ml graduations

Characterised Sets (part number 191806)

- **Must be used for rate accuracy calibration**
- **Sets are labeled with a serial number, a nominal volume and an expiry date (180 days from the date the set was characterised)**
- **Handle sets with care at all times. Sets must not be pressurised. Prior to loading or removing from the pump, manually open the auto-pinch-off mechanism. Do not stretch the set excessively**
- **Record the number of times each set is used in a log book. A set must not be used for more than 20 rate runs.**

Preparation:

1. Set up the equipment as shown.
   - The vertical distance from the fluid level of the container to the pump pressure transducer should be 34 ±4 inches
   - The burette zero line should be within ± 2 inches from the pump pressure transducer. Verify that the inside of the wall is free of droplets
   - Ensure fittings are secure and there is no leakage through the 3-way stopcock
   - Ensure that the air has been purged from the characterised set and all equipment
2. Close the set roller clamp.
3. Plug the pump into the AC mains and turn the pump **ON**.



Rate Accuracy Verification *(continued)*

Procedure:

1. Set the pump to Primary rate = **800** ml/h, VTBI = **OFF,** TOT VOL INF = **000.0** (or, if not using a flow sensor, set the pump to Primary rate = **800** ml/h, VTBI = **100** ml, TOT VOL INF = **000.0**).
2. With the pump displaying **START PRIMARY** or **ON HOLD PRIMARY**, press the **RUN/HOLD** switch to start the pump and simultaneously start the stopwatch. Allow the pump to run for 180 seconds (3 minutes) ± 0.5 seconds then press the **RUN/HOLD** switch to put the pump on hold.
3. Measure the volume in the burette and calculate the percentage of volume error using following formula:

Formula to calculate the percentage of volume error

$$\% \text{ volume error} = \frac{b - n}{n} \times 100$$

Where:

b = volume in burette

n = nominal volume as indicated on the characterised set

4. If the % volume error is ± 2% or less, the pump is within the correct specification. If not, repeat the test.

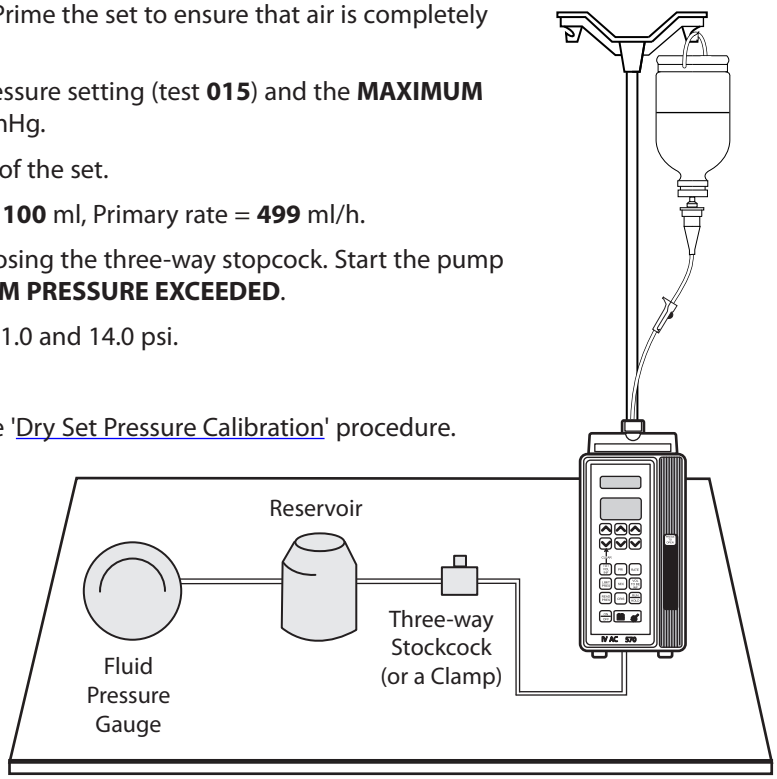
   If the pump fails a second time, perform the 'Rate Accuracy Calibration' procedure. See Chapter 2 for instructions.

Downstream Pressure Occlusion Test

Procedure:

1. Connect an IV infusion set to a fluid container. Prime the set to ensure that air is completely expelled.
2. Verify and, if necessary, adjust the **DEFAULT** pressure setting (test **015**) and the **MAXIMUM** (test **014**) occlusion pressure setting to **500** mmHg.
3. Connect a fluid pressure gauge to the luer end of the set.
4. Turn the pump **ON** and set the pump to VTBI = **100** ml, Primary rate = **499** ml/h.
5. Connect the pump to the pressure gauge by closing the three-way stopcock. Start the pump and allow it to run until it alarms **DOWNSTREAM PRESSURE EXCEEDED**.
6. Verify that the pressure gauge reads between 11.0 and 14.0 psi.
7. Open the stopcock to relieve the pressure.

   If the pump fails to alarm as stated, perform the 'Dry Set Pressure Calibration' procedure. See Chapter 2 for instructions.



Physical Inspection and Clean

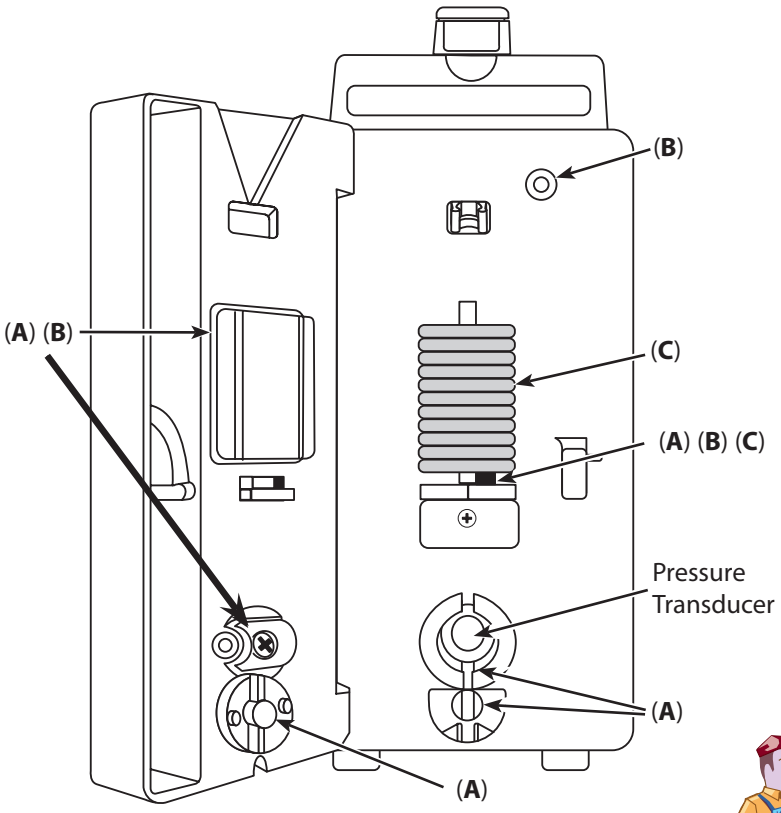
To ensure the pump remains in good operating condition, it is important to keep it clean and carry out the routine procedures described below.

- Routinely clean the pump, especially if spillage has occurred.

Before cleaning always switch OFF and disconnect from the AC power supply. Never allow fluid to enter the casing and avoid excess fluid build up on the pump.
Keep pump upright to prevent fluid entry around the pressure transducer.
Do not use aggressive cleaning agents as these may damage the exterior surface of the pump.
Do not steam autoclave, ethylene oxide sterilise or immerse this pump in any fluid.

- Unplug the power cord from the AC wall outlet before cleaning. Do not allow fluids to enter the pump case.
- Clean the exterior surfaces (the outer case top, bottom, sides; the switch panel, the front panel and inside the door) with a cloth dampened with warm water, or a mild non-abrasive detergent (such as commercially available dish cleaning liquid) mixed with water.

  Note: Alcohol, ammonia, acetone, benzene, phosphoric acid, xylene and similar solvents can erode (wear away pit) or otherwise damage the cam followers and other surfaces of the pump. The cam followers must be kept clean using a solution of warm water and a mild non-abrasive detergent, and inspected for possible erosion according to the procedure outlined on the following page, see 'Inspecting and Cleaning the Mechanism'.
- Check that labels are flat, legible and fully adhered. Replace as necessary.
- Inspect the case for loose or damaged components and replace if necessary.
- Inspect the circuit breaker for damage.
- Inspect the AC power supply plug and cable for damage.
- Inspect the door assembly for damage. Check that the door pivots freely and latches securely.
- Inspect the mechanism for fluid spill residue or foreign matter. Open the door and inspect the exposed cam followers, the pressure plate and tubing pincher. Clean any surfaces where solution has accumulated.



- Clean crevices (**A**) using a soft-bristle brush, such as a one-inch paint brush, dipped in the mild detergent solution (see above). Pat dry all moistened areas with a cloth then leave the door open for at least 15 minutes to air-dry crevices.
- Manually actuate points (**B**) by pressing then releasing each part to verify that it moves freely.
- After cleaning is complete, if required and where heavy spillage has required extensive cleaning, lubricate the tubing pincher and the sides of the mechanism (**C**) using a silicone-based grease.

  See also 'Inspecting and Cleaning the Mechanism' on the following page.

Do not use alcohol or alcohol-based cleaning agents on the surface of the pressure transducer.

Physical Inspection and Clean *(continued)*

Inspecting and Cleaning the Mechanism

Open the door and inspect/clean the exposed cam followers, the pressure plate and tubing pincher.

- Clean any surfaces where fluid spill residue is noted, referring to the cleaning instructions above for appropriate cleaning method.
- Check the Cam Followers for cleanliness and erosion:
  Shine a flashlight into the cam followers. The followers should be clean and shiny. A dull appearance may indicate erosion. If the followers appear to be dirty or are dull, clean per the following procedure.
- Clean the Cam Followers:
  Clean the surface of the cam followers using a cotton-tipped applicator dampened in a solution of warm soapy water and a mild non-abrasive detergent (such as commercially available dish cleaning liquid). Rinse the cam followers with a soft cloth or cotton-tipped applicator dampened in water then allow the cam followers to dry.
- Check the Cam Followers for erosion after cleaning:
  If, after cleaning the cam followers, they are still dull, replace the mechanism assembly per replacement instructions in Chapter 6 of this manual, or return the pump to the manufacturer.
- Verify that the Pressure Plate is not bent, cracked or deformed.
- Verify that the Tubing Pincher opens and closes freely (without sticking).

  If the pincher is sticking or is hard to actuate, remove the pincher cover and inspect for contamination or inadequate lubrication. Remove assembly and clean if necessary. See Chapter 6, 'Spare Parts Replacement Procedures' for pincher removal instructions.

  If required, apply a coating of silicone lubricant to cavity in front panel. Refit the pincher, pincher spring and pincher cover following the instructions in Chapter 6.

Flow Sensor Check (where flow sensor is in use)

Clean the flow sensor by wiping over with a cloth, lightly dampened with warm water and a standard disinfectant/detergent solution. Ensure the connector does not get wet. Dry flow sensor before use.
To aid cleaning of flow sensors which have been heavily soiled, contaminated or if the handles operation is not free, the flow sensor may be immersed and soaked in clean soapy water.
Activating the spring mechanism of the sensor whilst immersed will assist in cleaning the inside of the mechanism. After cleaning, the sensor should be allowed to dry fully prior to use.
CAUTION: the plug of the sensor should not be immersed as damage will occur.

- Check that labels are flat, legible and fully adhered. Replace as necessary.
- Check that lenses are clean and clear and show no sign of cracks.
- Inspect the body of the flow sensor for damage.
- Check that the sliding action of the flow sensor operates smoothly.
- Inspect the cord and plug for damage.

Performance Verification Procedure

Model / Serial Number:		**Service Order / Inventory Number:**		
Hospital Name / Reference:		**Software Version:**		
INSPECTION *CH3*	**Physical inspection and clean** Lubricate pincher cavity as required			
UPDATES	**Recommended when serviced**	UPDATE REF:	Fitted ✓	Not fitted / Not Applicable ✓
	Fit Strain Relief and Flexi Cable	CH6		
SELF TEST *CH4*	**Check all functions in self-test**			
	Dry set pressure verification (self-test 12) Use a dry set. Applied pressure = 0 mmHg Displayed pressure = -20 to +10 mmHg Applied pressure = 400 mmHg Displayed pressure = 367 to 423 mmHg			
	Vacuum retention verification (self-test 27) With door closed and set installed displayed pressure < -250 mmHg for 30 seconds			
INFUSING *CH3*	**Alarms functionality check** LOAD SET, DOOR, AIL, FLOW SENSOR, VTBI, KVO, TIME OUT, UPSTREAM OCCLUSION, BOTTLE CLAMP, DOWNSTREAM PRESSURE EXCEEDED, SET OUT Ensure pump works on battery and AC mains			
	Check operation with and without a Flow Sensor			
ON HOLD/OFF *CH3*	**APO test** (10 psi with door open and closed)			
VERIFICATION TESTS *CH3*	**Rate accuracy test** Set pump infusing at 800 ml/h for 180 seconds ± 0 5 seconds Delivery = 38 to 42 ml	_____ ml		
	Downstream pressure exceeded test Pressure set to 500 mmHg Pump occludes between 11 and 14 psi	_____ psi		
SETUP	**Set rate to zero (or lowest value possible), Clear Volume Infused and VTBI** **Clear Error / Alarm / Battery logs (as required)**			
ELECTRICAL SAFETY TESTS	**Class I Type CF** *Alternatively attach printed test results* Earth Resistance Test <= 0.2 Ω Earth Leakage Current <= 500 µA Enclosure Leakage Current <= 100 µA	_____ Ω _____ µA _____ µA		
Verification Performed By	_____ **Sign**	_____ **Print**	_____ **Date**	

CHX **indicates the chapter number in the Technical Service Manual (TSM) E.G.** *CH4* **= Refer to TSM Chapter 4.**

NOTE: The content of this Performance Verification procedure is accurate at the time of issue of this TSM and is based on PVP 100 Issue 2.

Chapter 4

Troubleshooting

In this chapter

Introduction	**38**
Error Messages	**38**
General Faults	**42**

Introduction

Use this troubleshooting guide to help identify the cause of errors and faults which may occur as a result of damage to the pump or failure of an internal component. The following tables list the error messages and general faults and describe what action to take to resolve the problem. For information on alarm procedures and messages, refer to the relevant *DFU*.

If the nature of the problem is unclear, enter self-test mode and step through the self-test functions to check that the main functions of the pump are operating correctly. See Chapter 3, 'Routine Maintenance' for details.

Test 016 READ ALARM HISTORY displays the sixteen most recent malfunction messages. To run test 016, enter self-test mode and select the test. See Chapter 3 for instructions.

Error Messages

Message	Failure	Action/Replace
AIR IN LINE	Air in IV infusion set detected by air-in-line sensor. IV infusion set removed from air-in-line detector or is not installed in lower tubing guides.	Purge air from IV infusion set. Check air-in-line sensor is clean. Check IV infusion set is properly installed in the air-in-line detector and into lower tubing guides.
AIR IN LINE *non-flow sensor operation*	Air in IV infusion set detected by air-in-line sensor. Empty container; clamp closed, upstream occlusion, flow sensor mispositioned, tubing/ bottle venting incorrect.	Purge air from IV infusion set. Check VTBI is set. Check equipment set up.
persistent AIR IN LINE	Air-in-line transmitter or receiver failure. VCO or timer failure.	Replace air-in-line receiver on the front panel. Replace air-in-line transmitter on the door. Replace Accessory Interface Board.
BOTTLE CLAMP *flow sensor operation only*	No fluid flow. Empty container; clamp closed, upstream occlusion, flow sensor mispositioned, tubing/ bottle venting incorrect.	Check equipment set up
CHECK DISC *non-flow sensor operation only*	Foreign matter lodged between pressure transducer and pressure disc. Pressure sensing disc improperly seated in retainer.	Remove pressure disc, inspect and remove any foreign matter then re-install disc. Open and close door to reestablish vacuum. If problem persists, check for blocked vacuum ports or leaks. See FIX ME Q actions. Upgrade software to Rev 3.01.
COM LINE *only when pump connected to a CIM*	Communication with external device has been disconnected.	Check connections; Check that external device is functioning. Important: Test **024** CIM ID must be set to **OFF** when CIM is not in use.
DOOR	Door open.	Close and latch the door.
DOWNSTREAM PRESSURE EXCEEDED	Downstream restriction, kinked tubing, clogged filter, or pressure limit exceeded.	Check overall setup, eliminate cause of alarm and restart pump. Verify that maximum or default pressure settings are not set too low for intended clinical application.
EXT ALARM *only when pump connected to a CIM*	Communication error between pump and external device.	Check connections; Check that external device is operating correctly. Important: Test **024** CIM ID must be set to **OFF** when CIM is not in use.

Error Messages *(continued)*

Message	Failure	Action/Replace
FIX ME 0	Microprocessor execution error.	Replace U28, U29 on Logic Board; Replace U1 on Logic Board.
FIX ME 1	Logic Board component failure (CRC check error).	Replace U13 on Logic Board; Replace U1 on Logic Board; Replace U28, U29 on Logic Board. Replace Logic Board.
FIX ME 2	Microprocessor failure (CPU error).	Replace U1 on Logic Board. If problem persists, follow FIX ME 1 actions.
FIX ME 3	RAM contents lost following loss of power. (RAM error). Occurs at power up after reconnection of AC and battery power.	Recycle power **ON/OFF** switch; Replace U28, U29 on Logic Board. If problem persists, follow FIX ME 1 actions.
FIX ME 4	Watchdog reset failure. Microprocessor, Watchdog or Interconnect cable failure.	Replace U7, U8 on Power Regulator Board; Replace U14 on Logic Board; Replace interconnect cable.
FIX ME 5	Numeric Display segment failure. Flex cable not correctly installed at J3. Display driver circuit or checking circuitry failure.	Reseat flex cable into J3 ensuring cable tabs are in line with connector tabs. Run Tests **03**, **04** and **05**. If Display and Front Panel switches function properly and do not stick then replace DS1-DS3. Replace flex cable. Replace Display Board.
FIX ME 6	Numeric Display digit select failure.	Run tests **03** and **17** to identify faulty digit or switch. Replace flex cable. Replace Display Board.
FIX ME 7	Segment check circuit failure.	Remove power to Logic Board to power down RAM. Replace flex cable. Replace Display Board.
FIX ME 8	Mechanism flag not detected at proper time (Motor revolution period error). Insufficiently lubricated mechanism. Failed or misaligned rotation sensor optics. Flag loose, mispositioned on mechanism cam pulley. Slipping mechanism cam or motor pulleys. Failed cable assembly. Failed Logic Board components. Failed motor drive circuitry on Power Regulator Board. Failed or misaligned motor; misaligned front panel. Cam followers damage; jammed cam follower assembly. Failed pressure plate.	Clean any dried solution in mechanism then lubricate along edges of cam followers. Verify pulleys do not slip; verify motor rotates and is not binding. Rotate motor by hand, run test **22** and observe port 16, bits 0 and 1. Check red/black motor wires for damage. Replace motor. Replace pulley belt. Replace Power Regulator Board.
FIX ME 9	Microprocessor malfunction (Background execution error).	Follow FIX ME 1 actions.
FIX ME A	Motor current not detected during power-up (Motor shutdown failure). Failed Logic Board or Power Regulator Board components. Failed motor.	Replace interconnect cable (Logic Board to power Regulator Board). Replace Logic Board. Replace Power Regulator Board. Replace motor.

Error Messages *(continued)*

Message	Failure	Action/Replace
FIX ME B	U14 on Logic Board failed power-up test (Counter timer failure).	Replace U14 on Logic Board; Replace U1, U13 on Logic Board. Replace Logic Board.
FIX ME C	Watchdog circuit failure at power-up.	Replace U7, Y1 on Power Regulator Board; Replace Power Regulator Board. Replace U14, U24 on Logic Board; Replace Logic Board.
FIX ME D	Speaker checker failure at power-up.	Replace speaker; Replace U4 or Power Regulator Board.
FIX ME E	Speaker failure at power-up. Speaker disconnected or failed.	Replace speaker; Replace Power Regulator Board.
FIX ME F	A/D converter failure at last power-down.	Replace U35 on Logic Board; Replace Logic Board or Analog Board. Check power supply reference voltage: On Power Regulator Board, test point = positive side of C16, limits 5.12 ±0.01 VDC; if not adjust R36.
FIX ME G	Watchdog check failure at last power-down.	Replace U7 on Power Regulator Board; Replace Power Regulator Board.
FIX ME H	Incorrect pressure applied during pressure calibration or internal adjustments out of tolerance.	Ensure correct calibration pressures are used, see 'Dry Set Pressure Calibration' procedure. Verify that pressure unit selection switch is in the correct position. Replace vacuum/pressure transducer assembly.
FIX ME J	Pressure transducer failure.	Check pressure adjustments, see FIX ME H. Replace pressure transducer/vacuum assembly.
FIX ME K	CIM ID entered without a CIM connected.	Change CIM ID setting to **OFF**, see test **024**.
FIX ME L	EEPROM failure	Replace U27 on Logic Board; Replace U23 on Logic Board.
FIX ME M	Air-in-line failure.	Replace air-in-line receiver on the front panel. Replace air-in-line transmitter on the door. Replace Accessory Interface Board.
FIX ME N	Motor rotation direction is reversed. One or both motor rotation sensors failed.	Check that connectors J13 and J16 on Accessory Interface Board are not reversed. Replace rotation sensor assembly.
FIX ME P	Set sensor failure: Set sensor detection failed when tested. Sensor exposed to direct sunlight on latch side of pump.	Locate pump away from direct sunlight. Replace the set sensor assembly.
FIX ME Q	Vacuum system failure.	Install new IV infusion set and run test **27**. Verify that the vacuum reading is **-250** or more negative when door is closed. Clean face of pressure transducer and check for damage. Check and replace Y-clip, door latch pin and door latch as necessary. Replace pressure transducer/vacuum assembly.

Error Messages *(continued)*

Message	Failure	Action/Replace
FIX ME R	Vacuum detect circuit failure.	Replace Accessory Interface Board.
FIX ME S	Pump was operating in Secondary or CRIS mode yet configured as PRI ONLY in test **031**. (Infusion mode error).	Replace U1 on Logic Board. Replace U28, U29 on Logic Board. If problem persists, follow FIX ME 1 actions, then FIX ME L actions as necessary.
FLOW SENSOR	Drops splashing in drip chamber. Drip chamber too full. Improper secondary set. Flow sensor mispositioned or removed/installed while pump is running.	Check for proper flow sensor set up and eliminate problem. For ambulation, slightly lower drip chamber fluid level if necessary.
persistent FLOW SENSOR	Flow sensor lenses obscured. Flow sensor wiring open or short-circuited. Analog Board circuitry failure.	Check for damage to flow sensor wiring from receptacle to Logic Board. Replace Analog Board, then Logic Board.
LOW BATT *alternating with the selected volume or pressure status*	Battery is almost discharged. Approximately 30 minutes of run time remain. Pumps continues to run but sounds a low-pitched, audible tone to alert user.	Operate on AC power. The battery will recharge while operating on AC power.
LOW BATT	Battery discharged; insufficient charge to operate pump. The pump will sound an alarm and stop operating.	Operate on AC power. The battery will recharge while operating on AC power. Note: A fully discharged battery can be recharged to a full charge in approx. 24 hours with the pump turned off and connected to AC power.
persistent LOW BATT *(even after charging)*	Weak battery. Battery charge circuit out of adjustment or malfunctioning. A/D converter (U16 on Logic Board) or Power Regulator Board component failure.	Check battery voltage is 14.4 ± 0.05 VDC. If necessary, adjust R10 on Power Regulator Board to achieve 14.4 ± 0.05 VDC.
RECONFIG REQUIRED	Invalid configuration or calibration data.	Run test **02** and identify invalid configuration then set configuration as necessary. If problem persists, run full self-test and perform all calibration procedures.
SET OUT	IV infusion set removed or improperly loaded. Incorrect IV infusion set used.	Load IV infusion set properly using correct IV infusion set.
persistent SET OUT	Set sensor does not detect that IV infusion set is loaded. Door sensor does not detect door is closed. Magnet broken, missing from door latch or magnet polarity reversed.	Check set sensor and door sensor using test **22**. Check for damaged or missing door latch magnet. Check magnet polarity is correct.
TIME OUT	2 minutes have elapsed since pump put on hold or since last switch was pressed. A switch is stuck or has been pressed and held for more than 1 minute.	Press the **RUN/HOLD** switch twice to continue infusion.
UPSTREAM OCCLUSION *non-flow sensor operation*	Clamp partially closed. Tubing above pump kinked. Fluid container is empty.	Check clamp is fully opened; Check for kinked tubing. Replace container if empty.

General Faults

Fault	Failure	Action/Replace
Circuit breaker tripped	Line voltage fluctuation. Short circuit in power supply or wiring. Fluid ingress. Power Regulator Board component failure.	Reset circuit breaker once. If it trips again, disconnect from AC power then: Check mains inlet for fluid ingress. Check power lead for damage. Replace Power Regulator Board. Replace transformer.
No response when switches are pressed	Failed switch. Failed or mispositioned flex cable. Failed Display Board components.	Run test **17**. Test switches while opening and closing door. Replace or reposition flex cable routed to J3. Replace Bezel/Switch Panel assembly. Replace Display Board.
No Display and no audible tone	Fuse blown. ON/OFF switch failure. Power Regulator Board or Logic Board circuitry failure. Bad battery.	Replace fuse F1 on Power Regulator Board. Replace Bezel/Switch Panel assembly. Check battery voltage is 14.4 ± 0.05 VDC, adjust R10 on Power Regulator Board if necessary. Replace Power Regulator Board or Logic Board.
No battery power	Clad fuse blown. Battery is disconnected, has a wiring problem or has failed.	Replace clad fuse on Power Regulator Board. If fuse blows repeatedly, verify that the battery charge voltage is 14.4 ± 0.05 VDC, adjust R10 on Power Regulator Board if necessary. Replace battery.
Scrambled or frozen Display	Microprocessor malfunction. Faulty flex cable.	Replace Y1 on Logic Board; Replace U1 on Logic Board. Check flex cable connection at J3 of Display Board. Replace Logic Board.
Momentary Display	Pump has automatically shut off due to low battery charge.	Plug power cord into AC mains.
Knocking noise	Dirt build-up around pressure plate.	Clean and inspect pressure plate.
Fuse blown (F1), intermittent FIX ME 0, FIX ME 3 or halted alarms	3/8" test connector cover screw shorted out.	Replace 3/8" screw with 1/4" screw (300330).

Chapter 5

Circuit Descriptions

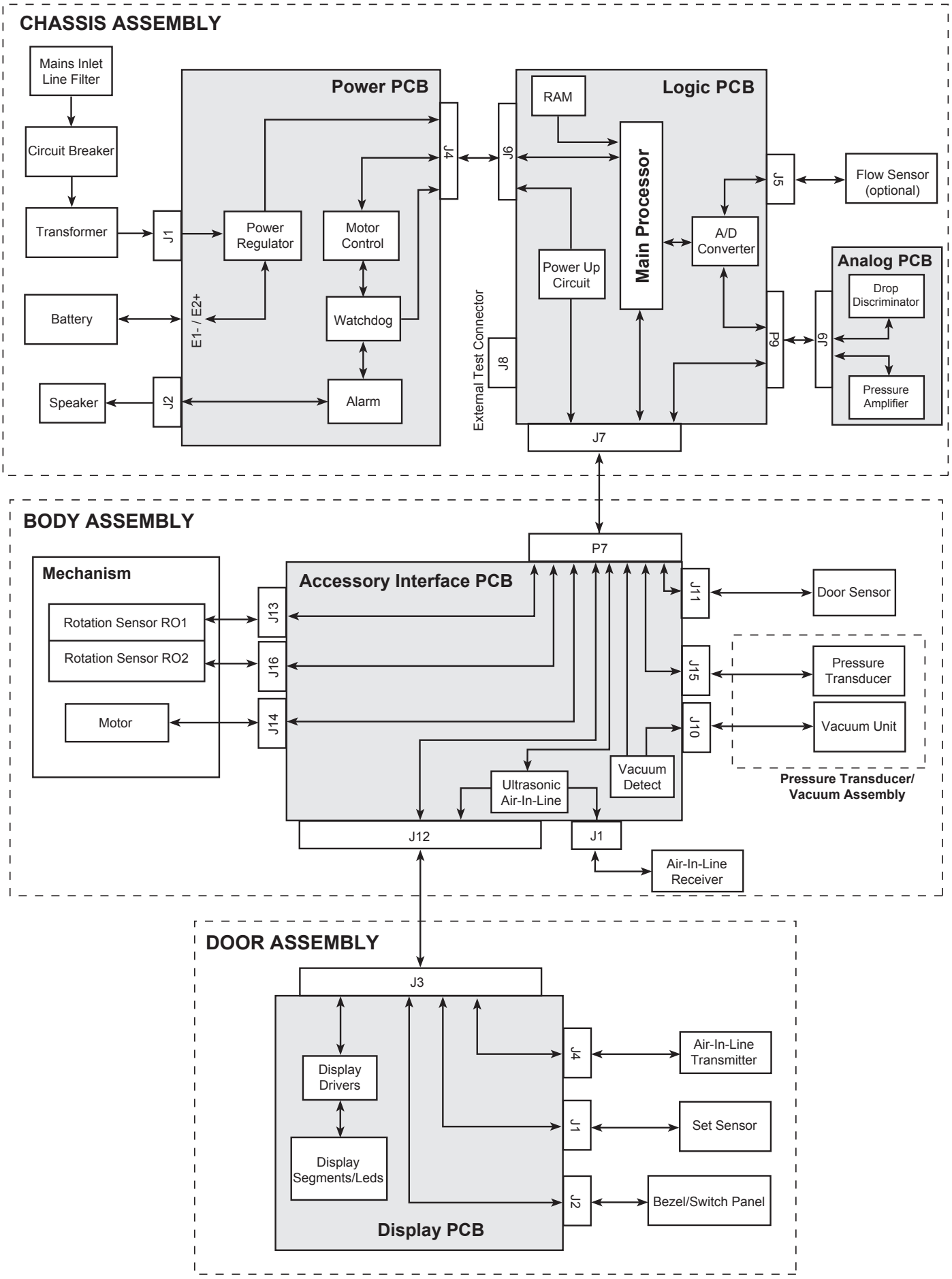
In this chapter

Functional Module Block Diagram 44

Module Overview Functional Description 45

Functional Module Block Diagram

IVAC® Volumetric Pump (Models 571 and 572)



Module Overview Functional Description

The IVAC® Volumetric Pump, Models 571 and 572 are designed to be serviced generally to major assembly level.

The main circuitry within the pump is contained on five printed circuit boards (PCBs): Logic PCB, Power Regulator PCB, Display PCB, Accessory Interface PCB, Analog PCB and a switch panel.

Cardinal Health will make available, on request, circuit diagrams which will assist appropriately qualified technical personnel to repair those parts of the device which are designated by the manufacturer as repairable.

Logic PCB

Contains the main processor module, memory circuits, I/O circuits and associated support circuitry which provide the control functions for almost all the aspects of the pump. It drives and monitors all other modules using the program code stored in the EPROM and the RAM ICs.

- **Main Processor**
  Consists of an 8-bit microcontroller with an internal clock generator, vectored interrupts and 64k byte addressing capability. The processor gets instructions from the program memory (EPROM U1 and RAM U28, U29) and then executes them.
- **Power Control Circuit (& On/Off Switch)**
  Consists of flip flop (U18) and gate (U17) which are powered from the VRAM supply so are operational even when the pump is off. The ON/OFF switch enables power to the system. It uses a single push switch on the front panel to toggle the flip flop (U18). Note if the battery voltage falls below 10.2V, the microprocessor asserts the OFF signal to toggle U18 into the power-off condition as if the ON/OFF switch has been pressed.
- **Wait-State Generator**
- **Memory Address Decoder**
  Decoding used to select EPROM U13 and RAMs U28 and U29 is provided by various logic circuits.
- **Read Only Memory (ROM)**
  The software program is stored in ROM (U13).
- **Electrically Erasable Programmable Read Only Memory (EEPROM)**
  U27, a 128 byte EEPROM is used to retain important user information such as calibration constants and operating parameter configurations.
- **Random Access Memory (RAM) and RAM test**
  U28 is the read/write memory type and a second RAM, U29, and various ICs form a hardware RAM test circuit.
- **I/O Decoding**
- **A/D Converter**
- **Analog Input Signals**
- **Output Ports/Input Ports**
- **Programmable Interval Timer**
- **Data Bus Buffer**

Power Regulator PCB

The Power Regulator PCB provides system power supplies, AC line and battery charging functions, motor control, watchdog and alarm driver circuits.

- **Transformer, Rectifier and Filter**
- **Line Regulator**
  Performs two functions, it is the main power source when the pump is connected to AC power and it keeps the battery charged by providing a nominal charge voltage of 2.35V per cell. The circuit uses an integrated circuit (U1) , configured as a fixed-frequency pulse modulation regulator.
- **AC Line Indicator**
- **AC Power Signal**
- **Power Control Circuitry**
- **+5L Regulator**
- **5.12V Reference and VRAM Regulator**
- **5V Switching Regulator**
- **Clock/Dividing Chain**
  Crystal Y1, with associated components form a crystal oscillator which clocks a binary counter. This counter provides a signal which in turn drives certain circuitry such as the watchdog alarm and provides timing for the line regulator and motor control circuitry.
- **Watchdog**
  Watchdog pulses enable this circuit to perform an integrity check on the microprocessor, generating an alarm if pulses are not received within a defined timing window.
- **Alarm Circuitry**
- **Motor Control Circuitry**
  The microprocessor drives the motor by stepping the current through each motor winding in the correct order to cause the motor shaft to turn. Digital signals from the Logic PCB determine the direction and duration of the current and the winding is increased/decreased to ensure sufficient torque to move the mechanism and to hold its position. The motor control circuit controls current across a bridge to the windings of the stepper motor using a pulse width modulation technique.

Battery

The sealed lead acid battery pack consists of six cells each with a potential of 1.8V to 2.40V, connected in series, a clad fuse (F2), and a 1.5A fuse (F1). The battery pack is rated at 2.5 Ah at 12 VDC.

Module Overview Functional Description *(continued)*

Analog PCB

Consists of two separate circuits, the drop discriminator which monitors the flow status and the pressure amplifier which amplifies the output of the pressure transducer.

- **Drop Discriminator**
  The drop discriminator circuitry is only active when a flow sensor is in use. The circuitry consists of a synchronous demodulator, differential amplifier, an LED driver, an AGC (automatic gain control) circuit and drop simulator circuitry.
- **Pressure Amplifier**
  The pressure amplifier circuitry comprises four functional blocks: the chopper/modulator input, the instrumentation amplifier, the demodulator and the output amplifier.

Accessory Interface PCB

Comprises the ultrasonic air-in-line detector and the vacuum detection circuitry. It also acts as an interface between the Logic PCB and various sensors and periphery devices including the door sensor, pressure sensor, Display PCB, motor and the rotation sensors.

Display PCB

This board comprises four 7-segment numeric displays, two 4-digit alphanumeric modules, battery and AC power LEDs and display circuitry which includes address decoders, display drivers, and check circuitry. The bezel/switch panel is an extension of the Display Board via P2.

Mechanism

The motor drives the timing pulley which in turn drives the CAM, turning the rotation flag. The rotation flag passes through the two rotation sensors. The function of these two rotation sensors is to verify that the motor is turning the correct direction.

Mains Inlet, Circuit Breaker and Transformer

The AC line voltage is connected to the step-down transformer through the circuit breaker. The secondary output of the transformer provides a nominal 24 VAC which is rectified through a full-wave rectifier, rectified and converted into an unregulated DC voltage.

Air-In-Line Detector System

Comprises two parts: the air-in-line receiver on the front panel and the air-in-line transmitter on the door. These parts sandwich the IV infusion set tubing when the door is closed and together with the air-in-line drive and detect circuit they ultrasonically sense air in the fluid path.

Transducer/Vacuum Assembly

The pressure transducer and the vacuum unit make up this assembly.

Pressure measurement is detected by the pressure sensor. Pressure sensor readings are provided by the transducer output voltage taken from a bridge circuit on the pressure transducer diaphragm.

A cylinder within the pump provides a vacuum to ports surrounding the front face of the pressure transducer to ensure firm coupling between the pressure sensor disc pad of the IV infusion set and the diaphragm of the transducer.

Chapter 6

Spare Parts Replacement Procedures

In this chapter

Introduction	48
Separating the Chassis and the Body	48
Chassis Assembly	49
Body Assembly	56
Door Assembly	68
Labels	76
Pole Clamp Assembly	81

Introduction

- **Ensure the pump is disconnected from the AC power supply and switched off before attempting to service the pump**
- **The pump contains static-sensitive components. Observe strict ESD precautions at all times**
- **Batteries should be disposed of as outlined by the local country regulations: do not send back to the manufacturer**
- **Only use Cardinal Health recommended spare parts**
- **Following all spare part replacement and repair activities, testing must be performed in accordance with the Performance Verification Procedure (PVP), see Chapter 3, 'Routine Maintenance'**

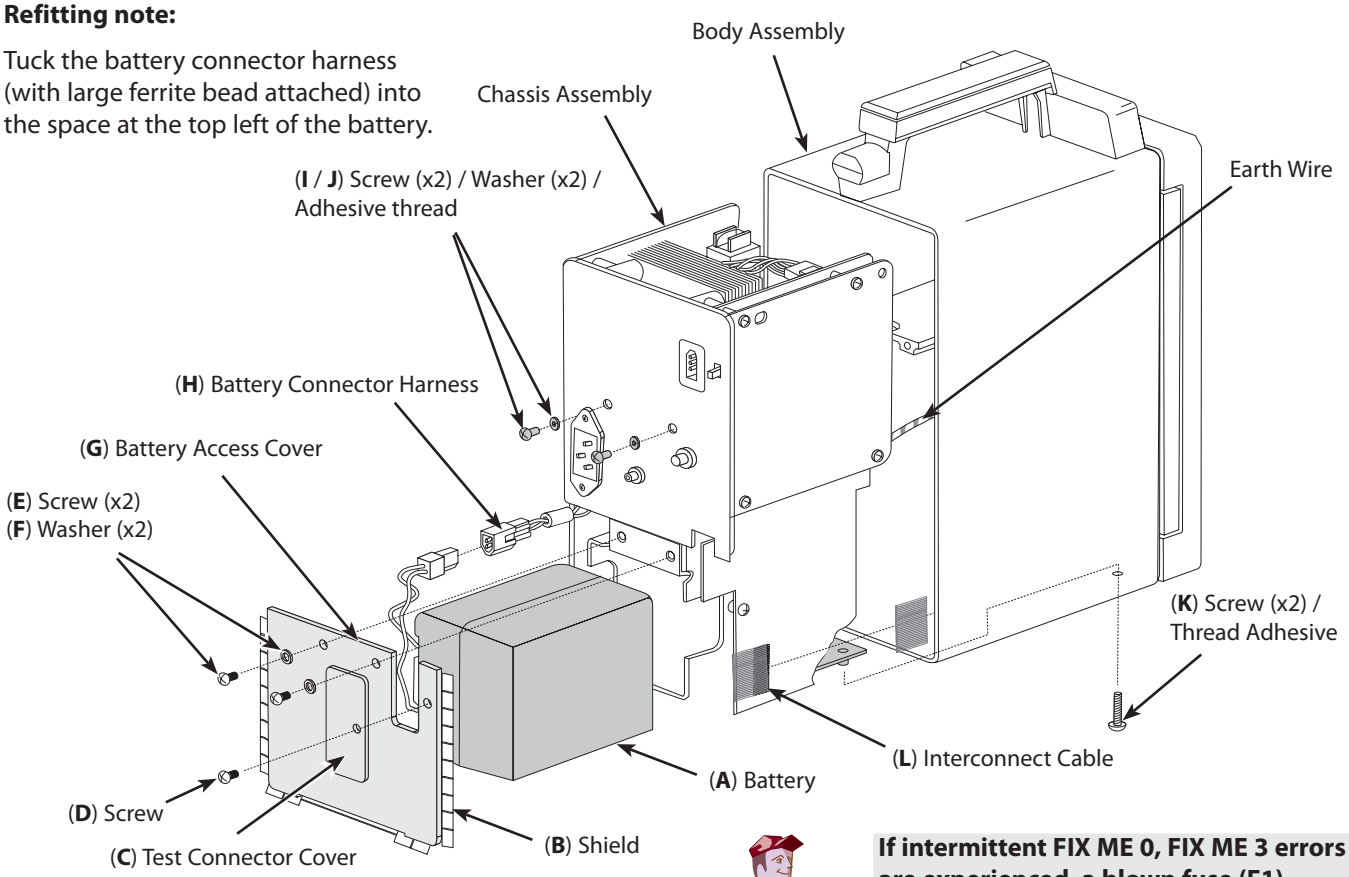
Separating the Chassis and the Body

Replacement Procedure

1. Remove the two screws and washers securing the battery access cover then remove the battery access cover and shield.
2. Slide out the battery pack and unplug the battery connector.
3. Remove the two screws from the bottom of the pump case.
4. Remove the two screws and two washers from the back panel of the chassis assembly.
5. Unplug the interconnect cable from the Accessory Interface Board.
6. Grasp and gently lift the battery housing then slide the chassis assembly out of the case.
7. Remove the one screw securing the earth wire to the mechanism assembly.
8. Reassemble in reverse order.

Refitting note:

Tuck the battery connector harness (with large ferrite bead attached) into the space at the top left of the battery.



If intermittent FIX ME 0, FIX ME 3 errors are experienced, a blown fuse (F1), halted alarms or the test connector cover screw (item (D) is a 3/8" screw, replace with 1/4" screw (300330).

Separating the Chassis and the Body

Spare Parts

Item	Description	Part Number
A	BATT PACK,26X/56X/57X	132412
B	SHIELD,BATT COVER,571/572	136730 (Model XCX)
C	COVER,CONN ACCESS,56X/57X	137715
D	SCREW,MACH 6-32X1/4 PNH PHH	300330
E	SCREW,MACH 6-32X3/8 PNH PHH	300034
F	WSHR,FL,.4BA T2 ST/STA2	0000ME00310
G	COVER,ACCESS,BATT,571/572	137503
H	ASSY, HARN, BATT, RFI, 56X/57X BOM	136331 (Models XBX, XCX)
H	ASSY,HARN,BATT,56X/570(BOM)	125429 (Model XAX)
I	SCREW,MACH 8-32X3/8 PNH PHH	300369
J	WSHR,FL,.174X.380X.032,PS	300038
K	SCREW,MACH 8-32X5/8 PNH PHH	300371
L	HARN,INTC,FOLDED,571/572	139435 (Models XBX, XCX)
L	HARN,INTCN,570	132626 (Model XAX)

Chassis Assembly

Introduction

To replace the components within the chassis assembly, follow the instructions in the relevant sections of this chapter. These sections are:

- Separating the Chassis and the Body
- Logic Board, Analog Board
- Power Regulator Board
- Transformer
- Circuit Breaker, AC Line Filter
- PE Connector
- Battery Housing, Speaker, Rear Panel

Chassis Assembly *(continued)*

Logic Board, Analog Board

Replacement Procedure

1. Remove the three screws (**A**) & (**D**) which secure the Logic and Analog boards to the chassis.
2. Remove the boards and slide out the flow sensor receptacle retainer.
3. Unplug the flow sensor receptacle assembly from the Logic Board (J5) and disconnect the interconnect cable (J6).
4. Remove the two screws which secure the boards together, only unscrewing the third screw and hex standoff (**B**) from the Analog Board if required.
5. Separate the boards by unplugging the connector in between the boards (J9) to (J9).
6. Reassemble in reverse order.

Power Regulator Board

Replacement Procedure

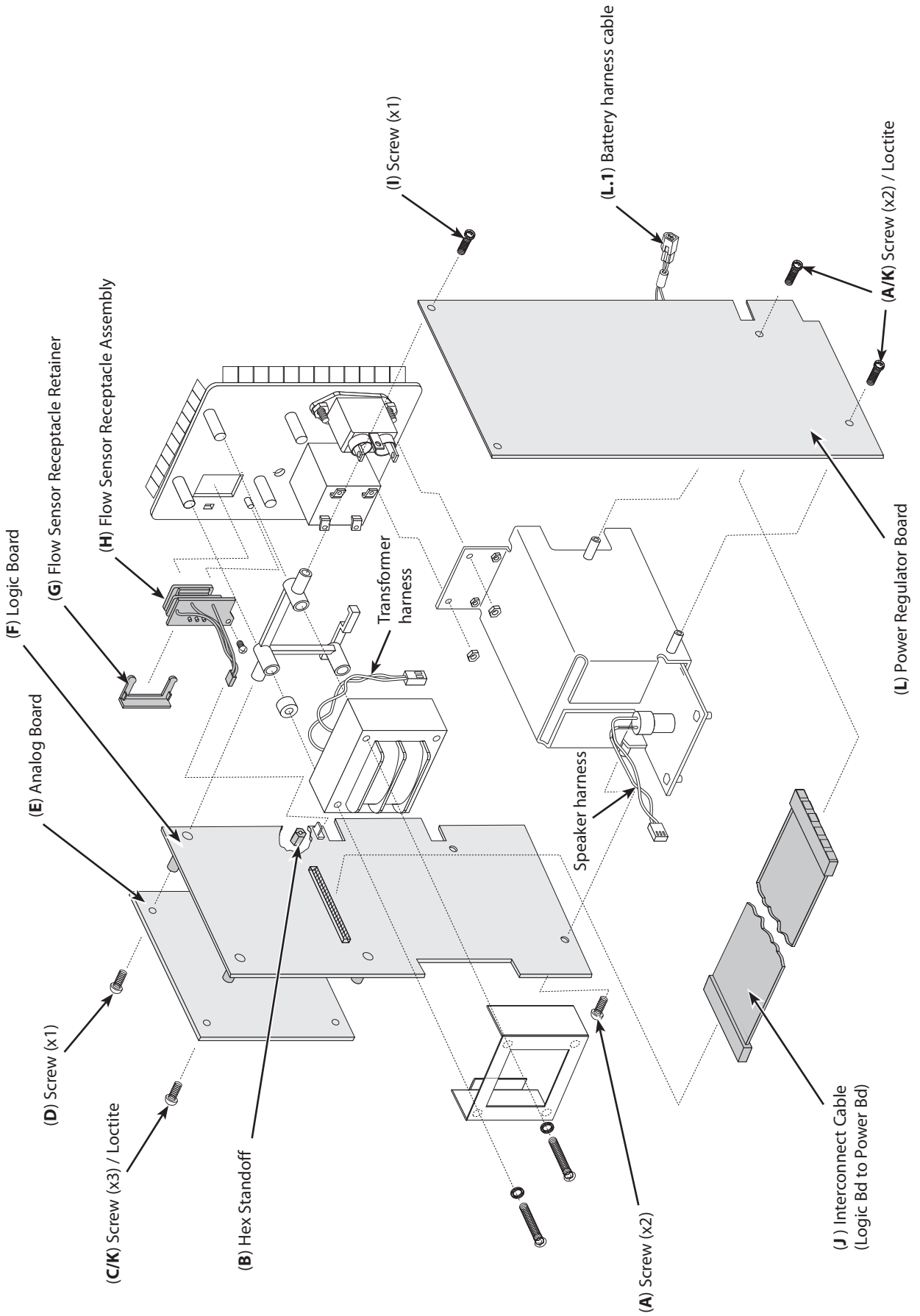
1. Remove the three screws (**I**) and (**A**).
2. Disconnect harness connections as required:
   - Transformer harness (J1)
   - Speaker harness (J2)
   - Interconnect cable (J4)
   - Battery harness cable
3. Reassemble in reverse order.

Spare Parts

Item	Description	Part Number
A	SCREW,MACH 6-32X1/2 PNH PHH	301828
B	STDOFF,HEX 6-32X7/16 AL ALY	302561
C	SCREW,MACH 6-32X3/8 PNH PHH	300034
D	SCREW,6-20X7/8 PHN PHH	303447
E	ASSY,ANLG BD,CAL,571/2(BOM)	139866
F	SERV ASSY,LGC BD,571/2(BOM)	139865
*	SERV ASSY,MEM,REV3.01,570(BOM)	145071 (Logic Bd U13)
*	IC,80C85A-2,MICROPROCESSOR,40D	303867 (Logic Bd U1)
*	IC,RAM,8KX8,CMOS,28 DIP	303639 (Logic Bd U28 & U29)
*	IC,CA3240 BIMOS OP AMP 8 DIP	302206 (Logic Bd U35)
*	IC,74HC273 20 DIP D FL-FL	303145 (Logic Bd U23 - U26)
*	IC,93C46,SERIAL EEPROM,8 DIP	303863 (Logic Bd U27)
*	IC,82C54,CMOS,COUNTER,24 DIP	303866 (Logic Bd U14)
*	IC,27C512,EPROM UV,512K 28 DIP	303636
*	HARN,INTC,FOLDED,571/572	139435 (Models XBX, XCX)
*	HARN,INTCN,570	132626 (Model XAX)
G	RETAINER,REC	125382
H	ASSY,FLOW SNSR BD,571/572	137032 (Models XBX, XCX)
H	ASSY,HARN,DP SNSR REC,56X/57X	125436 (Model XAX)
I	SCREW,TPG 6-20X3/8 BI PHH	301407
J	ASSY,CABLE,FLAT,56X/57X(BOM)	10014086
K	ADHESIVE LOCTITE 243	0000ME00672
L	ASSY,PWR REG BD,CAL,56X/57X	139867
L.1	ASSY, HARN, BATT, RFI, 56X/57X BOM	136331 (Models XBX, XCX)
L.1	ASSY,HARN,BATT,56X/570(BOM)	125429 (Model XAX)
*	IC,TL494 VOLT REG 16 DIP	302196 (Power Bd U1)
*	IC,4013B CMOS FL/FL 14 DIP	301632 (Power Bd U7)
*	IC,4093B CMOS 2-IN NAND 14 DIP	302123 (Power Bd U8)
*	XTAL,QTZ 2.29376 MHZ	302155 (Power Bd Y1)
*	IC,LM393N VOLT COMP 8 DIP	302369 (Power Bd U4)
*	CLIP,FUSE PC/TABS 0.250 DIA	303164
*	FUSE,SUB-MINI 5A 125V	303425
*	FUSE,1.5A,250V,NORM-BLO	303910

* item not shown

Logic Board, Analog Board, Power Regulator Board *(continued)*



Chassis Assembly *(continued)*

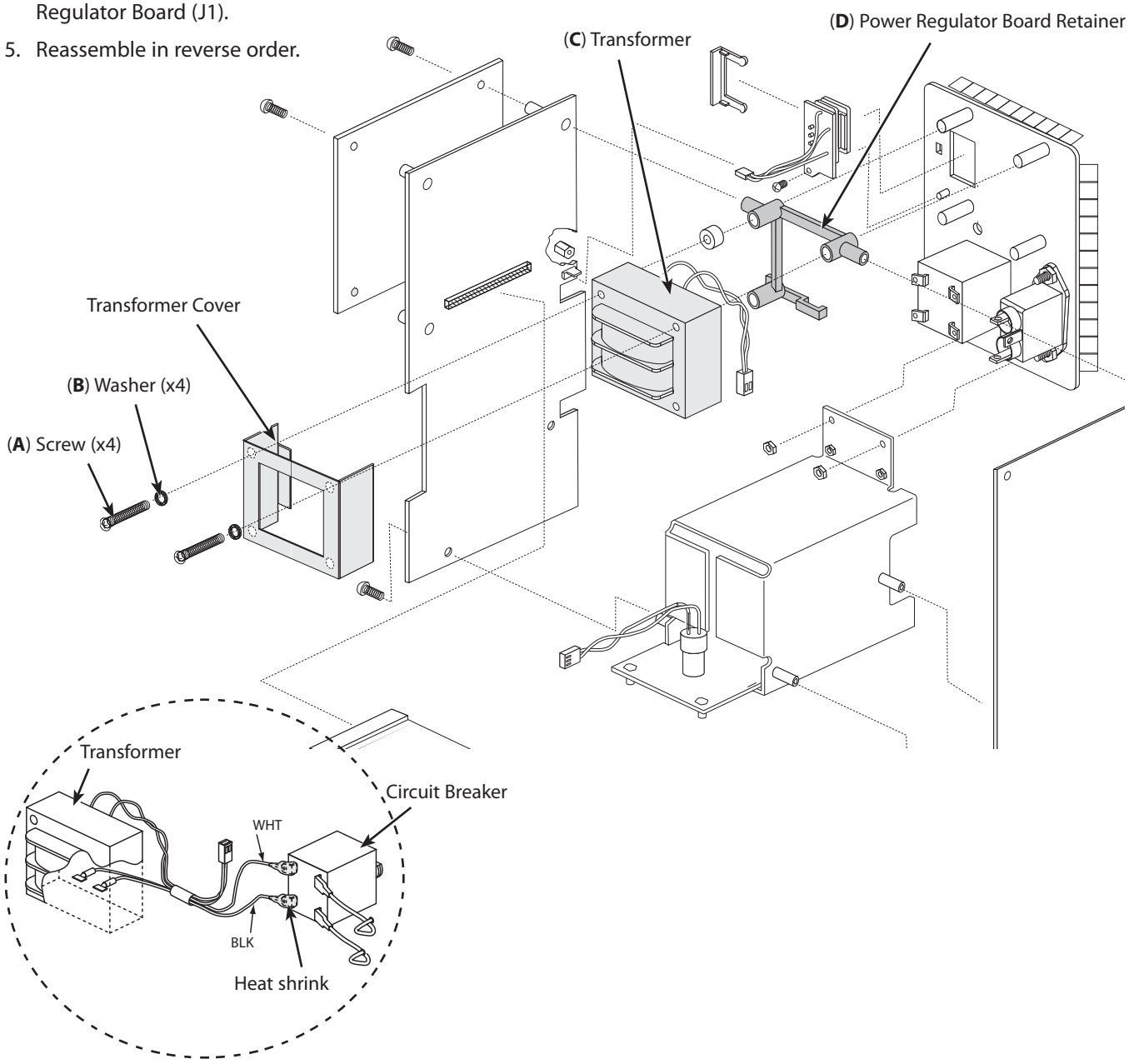
Transformer

Refitting note: When refitting the transformer, circuit breaker and AC line filter, it is important to ensure that the transformer wires are placed under the Power Regulator Board retainer (D) without being pinched:

1. Position the retainer.
2. Place wires under tab guide of retainer.
3. Secure transformer with the four screws.

Replacement Procedure

1. Remove the four screws and washers securing the transformer assembly. Remove the transformer assembly.
2. Remove the Power Regulator Board retainer.
3. As required, cut away heat shrink then desolder and remove the black and white wires from the circuit breaker.
4. Disconnect the cable harness from the Power Regulator Board (J1).
5. Reassemble in reverse order.



Spare Parts

Item	Description	Part Number
A	SCREW,MACH 8-32X1 1/2 PNH PHH	301126
B	WSHR,SPLIT,.168X.296X.040,PS	300037
C	ASSY,XFMR,220V 571/572(BOM)	139009
D	RETAINER,PW BD	125383

Chassis Assembly *(continued)*

Circuit Breaker, AC Line Filter

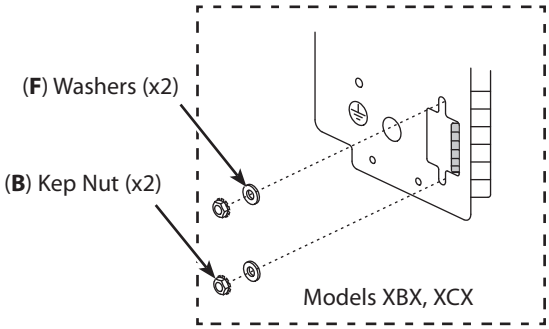
Replacement Procedure

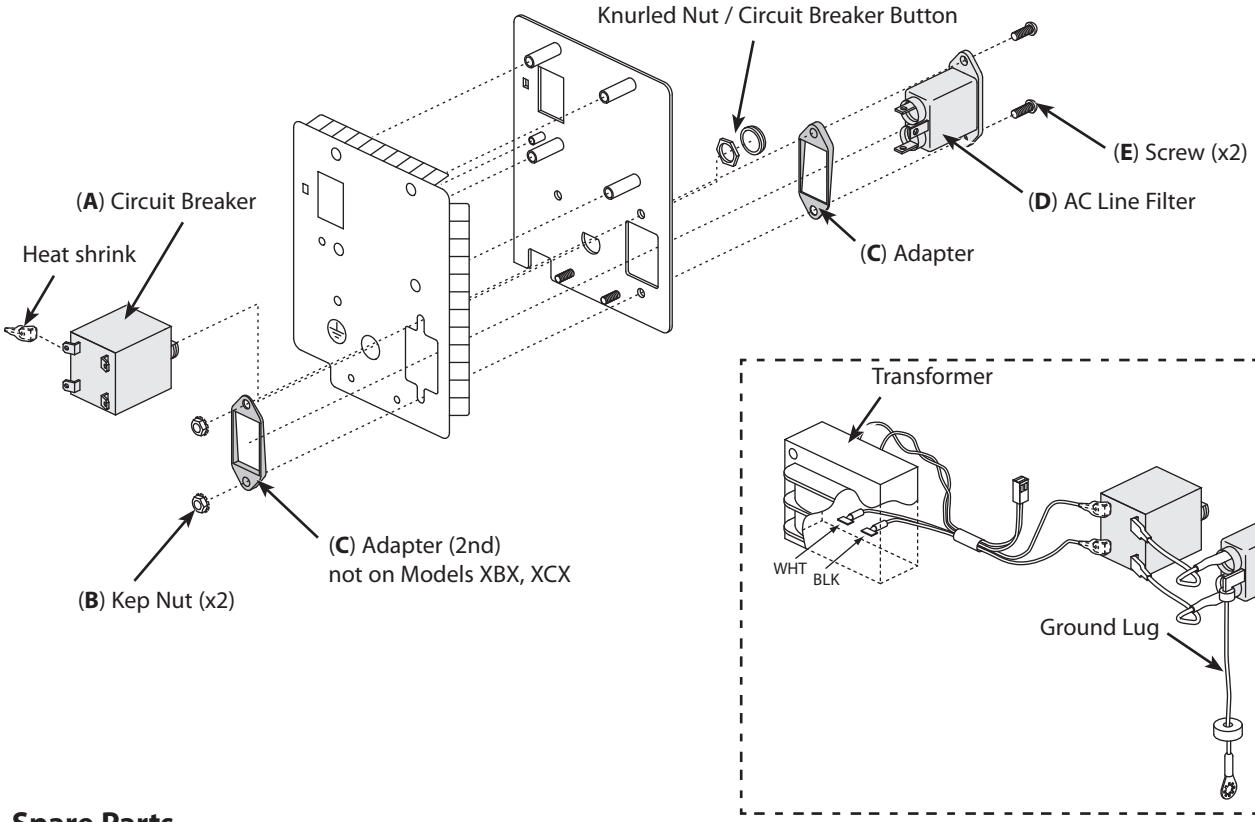
1. Remove the knurled nut which secures the circuit breaker button to the rear panel.
2. Desolder and remove the black and white wires, cutting away heat shrink as required. Disconnect the crimp connectors. Remove the circuit breaker.
3. Remove the two screws from the mains inlet on the outside of the rear panel and the two kep nuts securing the AC line filter on the inside.
4. Disconnect the blue, brown and ground lug wires from the AC line filter.
5. Slide the AC line filter out from the back, removing the two adapters (one adapter on Models XBX, XCX).
6. Reassemble in reverse order.

Refitting notes:

When refitting the AC line filter:

- Place one of the adapters over on the AC line filter with the thick section at the *top*. Slip the AC line filter through the back then place the 2nd adapter over the filter with the thick section at the *bottom*.
- Ensure the AC line filter is orientated so that the earth pin is nearest to the outer edge of the pump.





Spare Parts

Item	Description	Part Number
A	BREAKER,CIRCUIT,571/572	137441
B	NUT,KEP 6-32 S PL	300036
C	ADPT,LINE FILTER,56X/57X/220V	125389
D	FILTER,EMI,LINE,120/250,1A	304746
E	SCREW,MACH 6-32X3/4 PNH PHH	300360
F	WSHR,FL,M 6,BRASS,NICKEL PLT	303736

Chassis Assembly *(continued)*

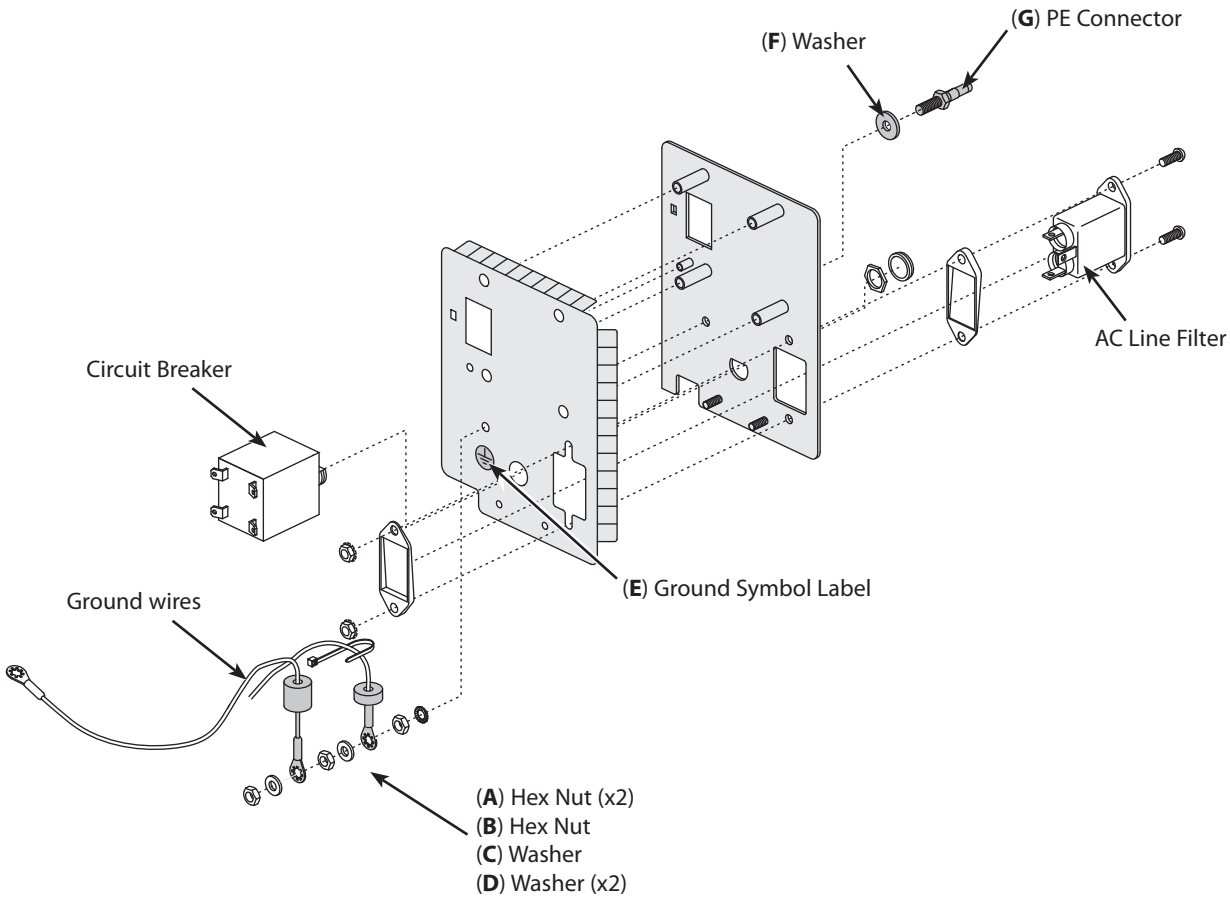
PE Connector

Replacement Procedure

1. Remove the three hex nuts and washers from inside the rear panel.
2. Cut the tie strap securing the ground wires.
3. Remove the PE stud connector and washer from the rear panel.
4. Reassemble in reverse order.

Refitting note:

If not already fitted, secure the ground wires with a tie strap.



Spare Parts

Item	Description	Part Number
A	NUT,HEX 6MM METRIC,3.2MM THK	303742
B	NUT,HEX METRIC, M6, 5MM THK	303740
C	WSHR,FL,M 6,BRASS,NICKEL PLT	303736
D	WASHER,EXT T LKG,6MM,CS CAD PL	303737
E	LBL,GND SYM	123273
F	WSHR,COLOR CODE,YEL/GRN,NPS	303739
G	CONN,PLUG 0.984 MTG STUD	303734

Chassis Assembly *(continued)*

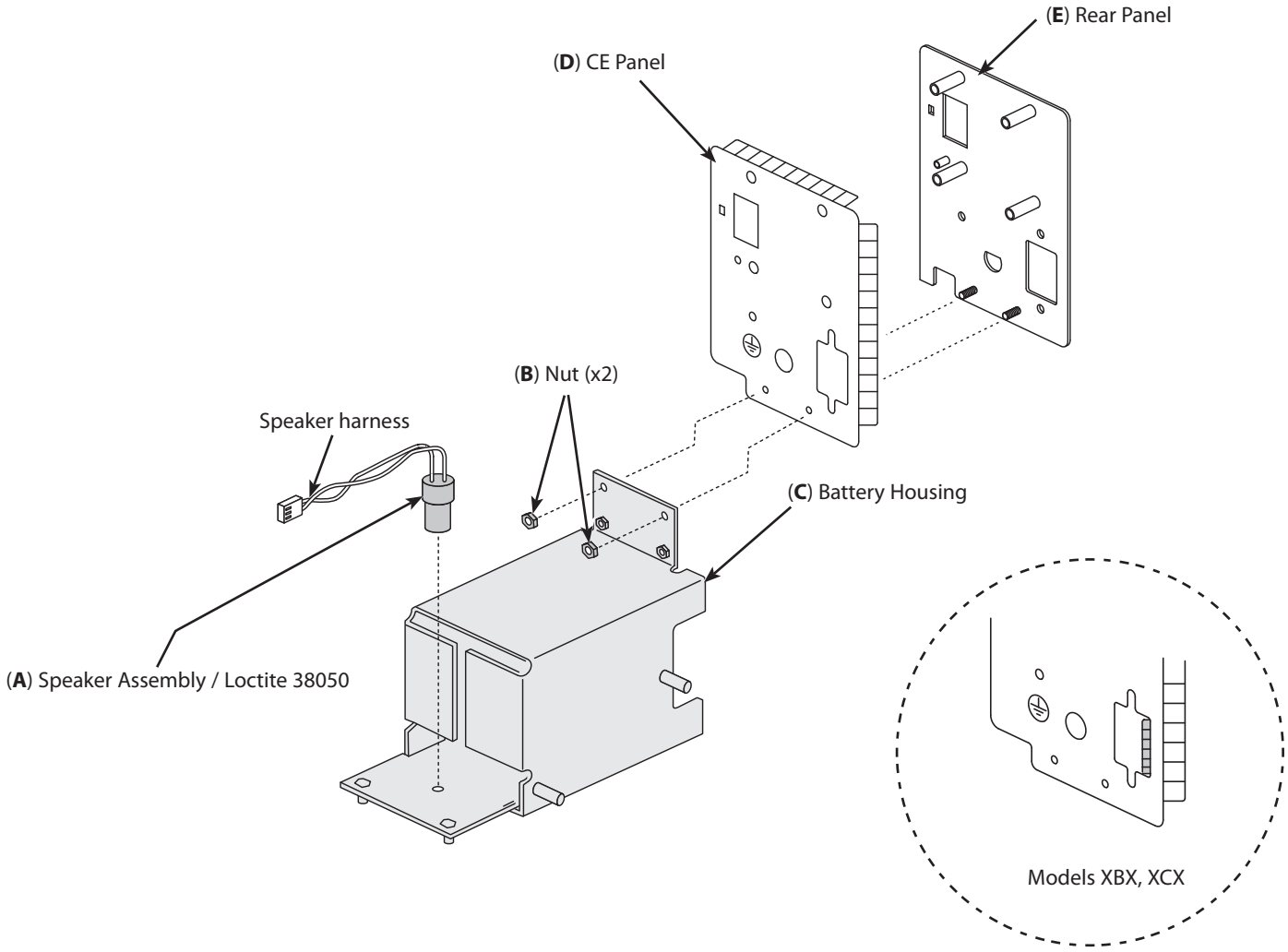
Battery Housing, Speaker, Rear Panel

Replacement Procedure

1. Disconnect the speaker harness from the Power Regulator Board (J2).
2. Remove the speaker assembly by breaking it loose from the battery housing.
3. Remove the two nuts securing the battery housing to the rear panel assembly.
4. Remove the CE panel and rear panel as required.
5. Reassemble in reverse order.

Refitting note:

Use Loctite 38050 to fix the speaker in place.



Spare Parts

A	ASSY,SPEAKER,56X/57X(BOM)	125425
B	NUT,KEP 6-32 S PL	300036
C	HSG,BATT,56X/57X	125318
D	KIT,CE PANEL,571/2	136853
E	ASSY, PANEL REAR ,RFI,571/572XB	137851

Body Assembly

Introduction

To replace the components within the body assembly, follow the instructions in the relevant sections of this chapter. These sections are:

- Separating the Chassis and the Body
- Y-Clip, Pressure Transducer/Vacuum Assembly
- Door Sensor Assembly
- Air-In-Line Receiver Assembly
- Pincher Mechanism
- Mechanism Assembly: Rotation Sensor Assembly, Motor, Timing Pulleys, Belt
- Accessory Interface Board
- Separating the Front Panel Assembly from the Case
- Cover Assembly, Handle, Bumpers, Fastener Clips

Important note: The Front Panel and the Door are *not* serviceable.

If replacement of these components is required, contact your local Cardinal Health Affiliate Office or Distributor for advice.

Y-Clip, Pressure Transducer/Vacuum Assembly

Replacement Procedure

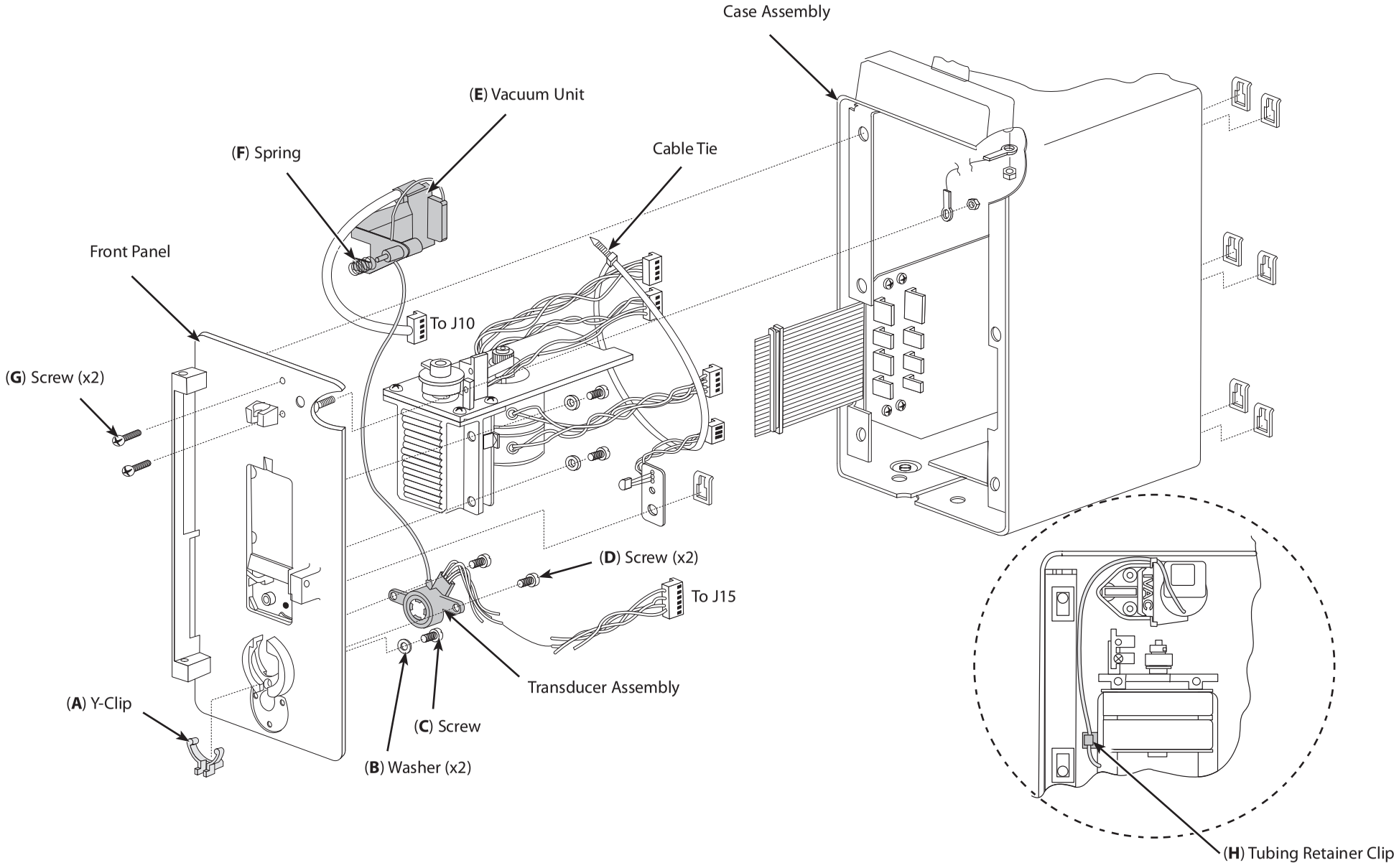
1. Remove the one screw and two washers securing the Y-clip. Remove the Y-clip.
2. Remove the two mounting screws securing the pressure transducer to the front panel.
3. Remove the two screws securing the vacuum unit to the front panel.
4. Pull the tubing (which connects the pressure transducer and the vacuum unit) out of the retaining clip.
5. Disconnect the vacuum unit connector (J10) and the pressure transducer (J15) from the Accessory Interface Board, removing cable ties as required.
6. Withdraw the pressure transducer/vacuum assembly from the body.
7. Remove the plunger spring from the vacuum unit as required.
8. Reassemble in reverse order.

Spare Parts

Item	Description	Part Number
A	CLIP,Y,570	132801
B	WSHR,FL,.174X.380X.032,PS	300038
C	SCREW,MACH,6-32X3/16,PNH,PHH	304209
D	SCREW,MACH 8-32X1/4 PNH PHH	300055
E	SERV ASSY,PRES,VACUUM,57X	141176
F	SPRING,PLUNGER,56X/57X	133246
G	SCREW MACH 6-32 X3/8 PNH PHHSS	303938
H	CLIP,CORD,.18 DIA,ADH BK,NYL	303106

Body Assembly

Y-Clip, Pressure Transducer/Vacuum Assembly *(continued)*



Body Assembly *(continued)*

Door Sensor Assembly

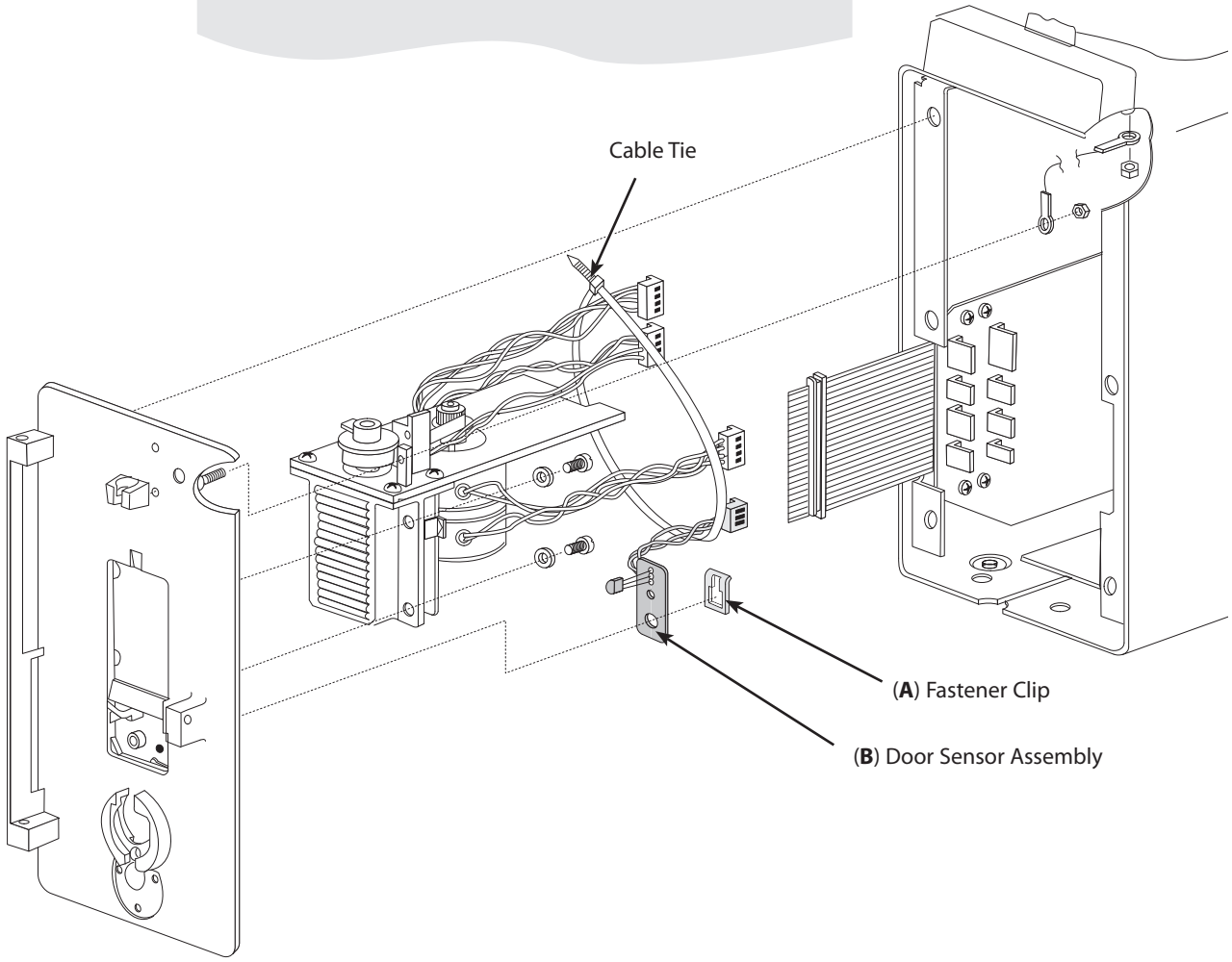
Replacement Procedure

1. Unfasten the one retaining clip which secures the door sensor assembly to the inside of the front panel.
2. Disconnect the wiring harness (J11) from the Accessory Interface Board, removing cable ties as required.
3. Withdraw the door sensor assembly.
4. Reassemble in reverse order.

Refitting note:

Insert the door sensor assembly through the front panel, mount on peg and secure with clip.

To provide a clear view of the fitting area, the illustration below shows the door removed. The door is *not* serviceable.
If a replacement door is required, contact your local Cardinal Health Affiliate Office or Distributor for advice.



Spare Parts

Item	Description	Part Number
A	FSTNR,SPD NUT LKG 0.250 SSTUD	302902
B	ASSY,DOOR SNSR BD,56X/57X(BOM)	132536

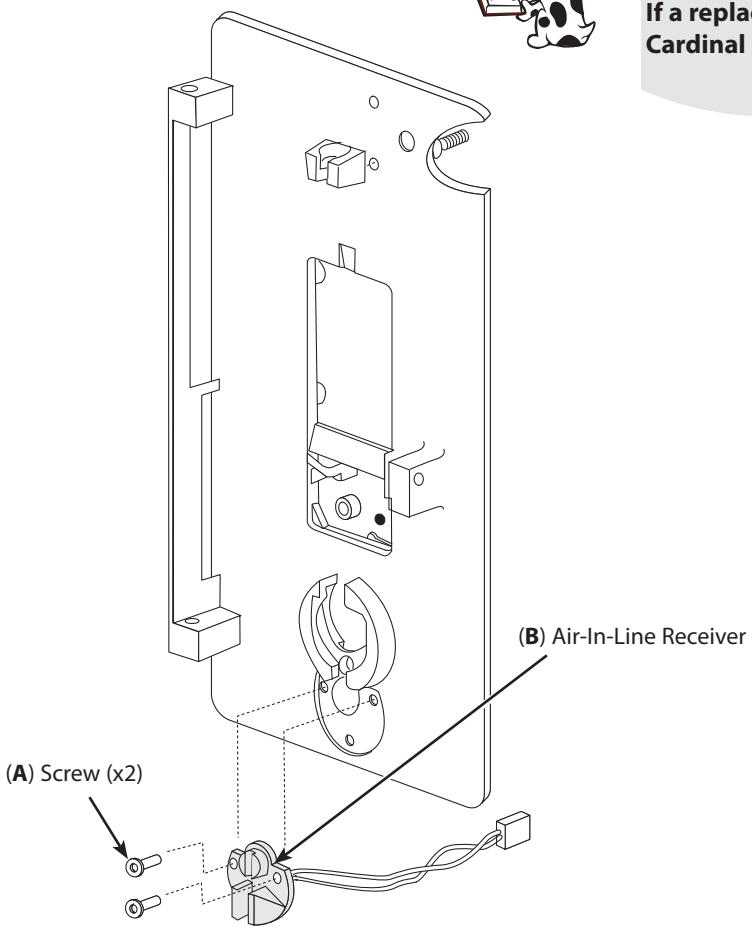
Body Assembly *(continued)*

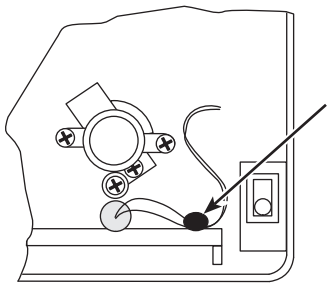
Air-In-Line Receiver Assembly

Replacement Procedure

1. Remove the two screws securing the air-in-line receiver assembly to the front panel.
2. Disconnect the wiring harness from the Accessory Interface Board (J1) and pull the wiring harness free of the silicone fixing on the inside of the front panel.
3. Remove the air-in-line receiver assembly, drawing the wiring harness out through the front panel hole..
4. Reassemble in reverse order.

To provide a clear view of the fitting area, the illustration below shows the door removed. The door is *not* serviceable.
If a replacement door is required, contact your local Cardinal Health Affiliate Office or Distributor for advice.





Refitting note:

Secure the wiring harness with adhesive silicone, RTV 162 as shown

Front Panel Back View

Spare Parts

Item	Description	Part Number
A	SCREW,CAP,4-40X1/4,BUTH,HXSO	304172
B	ASSY,AIL,RECEIVER,57X(BOM)	133996

Body Assembly *(continued)*

Pincher Mechanism

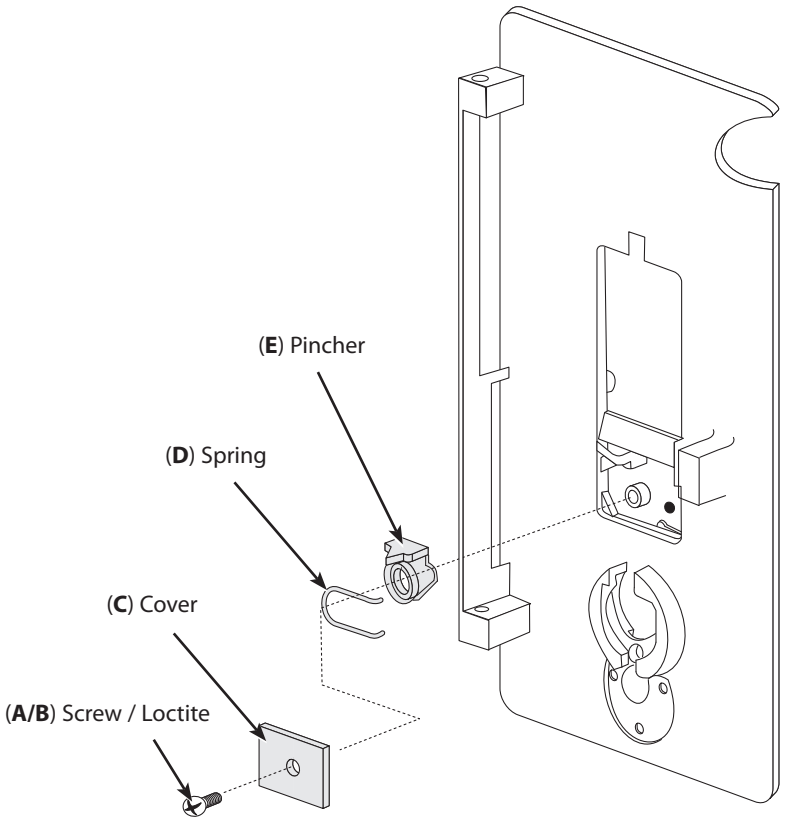
Replacement Procedure

1. Remove the one screw securing the pincher mechanism to the front panel.
2. Remove the cover plate, spring and the pincher.
3. Reassemble in reverse order.

Refitting note:

Use Loctite 243 on the securing screw.

To provide a clear view of the fitting area, the illustration below shows the door removed. The door is *not* serviceable.
If a replacement door is required, contact your local Cardinal Health Affiliate Office or Distributor for advice.



Spare Parts

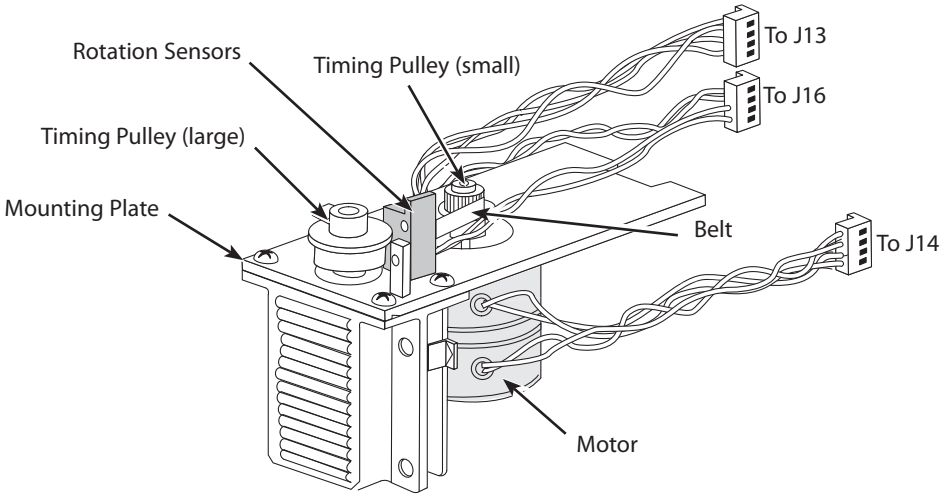
Item	Description	Part Number
A	SCREW,CAP 6-32X1/4 FLH HXSO	301164
B	ADHESIVE LOCTITE 243	0000ME00672
C	COVER,PINCHER,56X/57X(BOM)	125321
D	SPRING,CAM,56X	125768
E	PINCHER,56X/57X	133248

Body Assembly *(continued)*

Mechanism Assembly

To carry out repairs and/or replacement of the body assembly components, follow the instructions in the relevant sections of this chapter.

Important: Breakdown of the mechanism assembly is limited to replacement of the motor, the rotation sensor assembly, the two timing pulleys and the timing belt only. Do not attempt to disassemble the Front Panel Assembly any further.
If repair of any other mechanism components is necessary, contact your local Cardinal Health Affiliate Office or Distributor for advice.



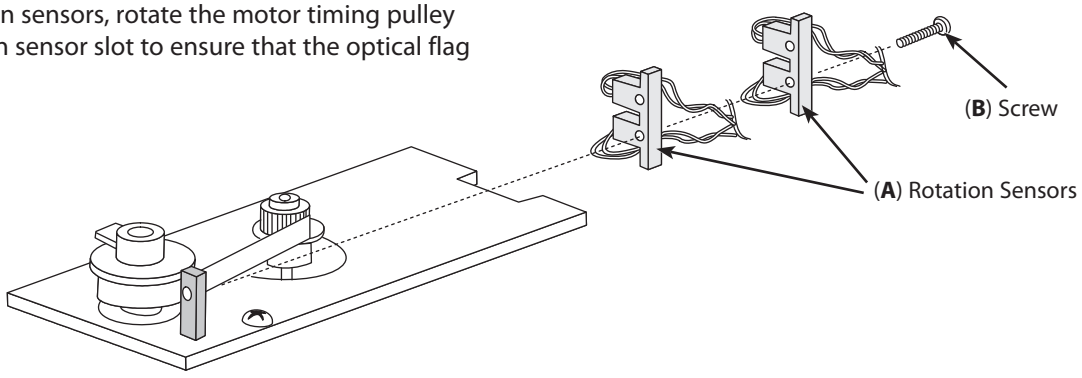
Rotation Sensor Assembly

Replacement Procedure

1. Disconnect the rotation sensor assembly wiring harness from the Accessory Interface Board (J16 = back sensor, J13 = front sensor), removing cable ties as required.
2. Remove the one screw which secures both rotation sensors. Withdraw the rotation sensor assembly.
3. Reassemble in reverse order.

Refitting note:

After fixing the rotation sensors, rotate the motor timing pulley and adjust the rotation sensor slot to ensure that the optical flag rotates freely.



Spare Parts

Item	Description	Part Number
A	ASSY,HARN,ROTN SNSR,56X/57X	125445
B	SCREW,MACH 4-40X5/8 PNH PHH	300347

Body Assembly *(continued)*

Mechanism Assembly *(continued)*

Motor

Replacement Procedure

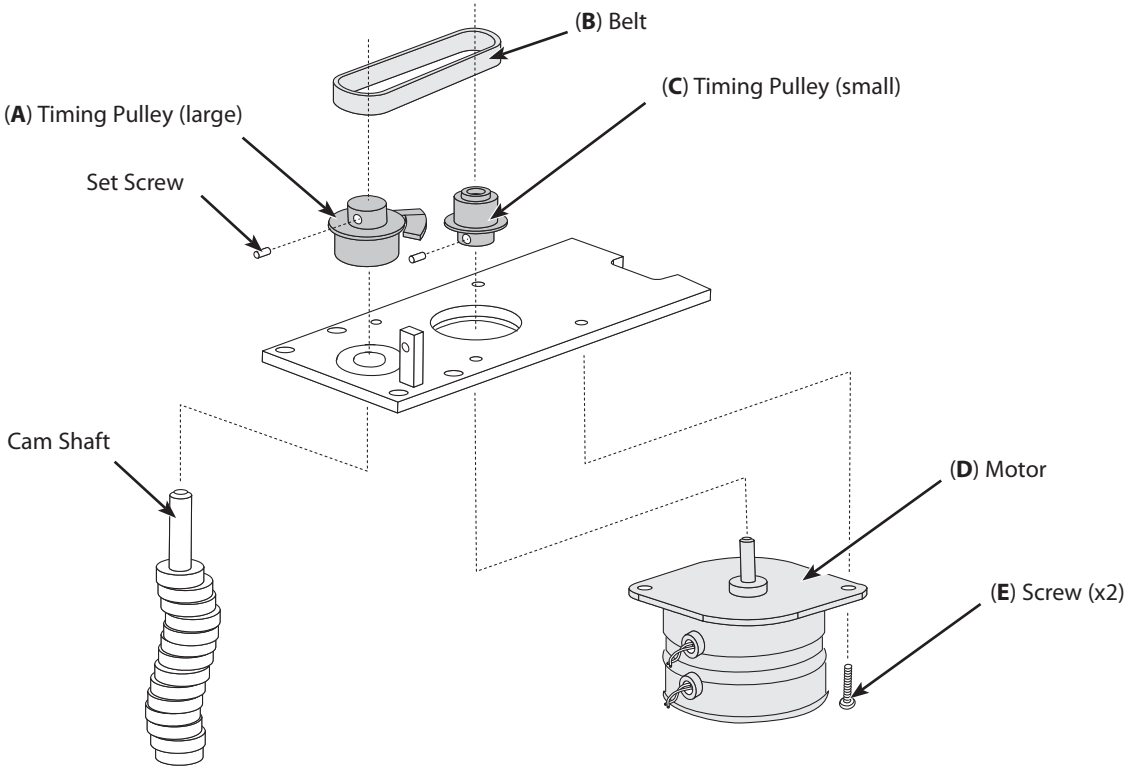
1. Disconnect the motor connector (J14) from the Accessory Interface Board, removing cable ties as required.
2. Holding the motor in place, use a flexible or right-angled screwdriver to remove the two screws which secure the motor to the motor mounting plate.
3. Remove the motor.
4. Measure and record the distance between the small timing pulley and the motor surface.
5. Loosen the set screw which secures the small timing pulley to the motor then pull up to remove it.
6. Reassemble in reverse order, referring to 'Refitting notes' on the next page.

Timing Pulleys, Belt

Replacement Procedure

1. Loosen the set screw securing the large pulley timing assembly then pull up to remove it from the cam shaft.
2. Remove the belt from around the pulley as required.
3. Reassemble in reverse order, referring to 'Refitting notes' on the next page.

To provide a clear view of the fitting area, the mechanism is shown here broken down, however, breakdown of the mechanism assembly is limited to replacement of the motor, the rotation sensor assembly, the two timing pulleys and the timing belt. Do not attempt to disassemble the Front Panel Assembly any further.



Spare Parts

Item	Description	Part Number
A	ASSY,TIMING PULLEY,57X(BOM)	131002
B	BELT,TMG 79GRV 0.080P	302878
C	PULLEY, TMG 24 GRV 0.080P	302876
D	MOTOR 4-WIRE 56X57X	10013683
E	SCREW,MACH 6-32X3/8 PNH PHH	300034

Body Assembly *(continued)*

Mechanism Assembly *(continued)*

Motor, Timing Pulleys, Belt *(continued)*

Refitting notes:

1) When refitting the motor, align the two diagonal motor mounting holes with the motor mounting plate before securing the motor in place with the two screws. Use Loctite 243 on the two screws.
2) When refitting timing pulley (small) onto a replacement motor, install it at the same height as recorded from the old motor.
3) When refitting the belt, verify the belt tension by pushing on the belt between the pulleys. The belt should easily push (> 5 pounds of force) by approx. 0.1 to 0.2 inches. Tighten or loosen the belt as required:
   - Loosen the two motor screws and hold the motor to the mounting plates
   - Push motor towards the front of the case to lessen belt tension OR pull the motor towards the rear of the case to increase belt tension.
   - Retighten the two screws and recheck belt tension.
4) Position timing pulley (large) onto the cam shaft just far enough to keep it off the mechanism plate then tighten the set screw. When replacing the timing pulley (large), tighten the set screw onto the flat of the cam shaft to ensure correct flag orientation.

   Turn timing pulley (large) so the flag on the timing pulley passes through the optical sensors freely. Ensure the flag does not rub the sensors. If so, loosen the rotation sensor fixing screw, reposition the flag then retighten the rotation sensors screw ensuring the rotation sensors do not move.

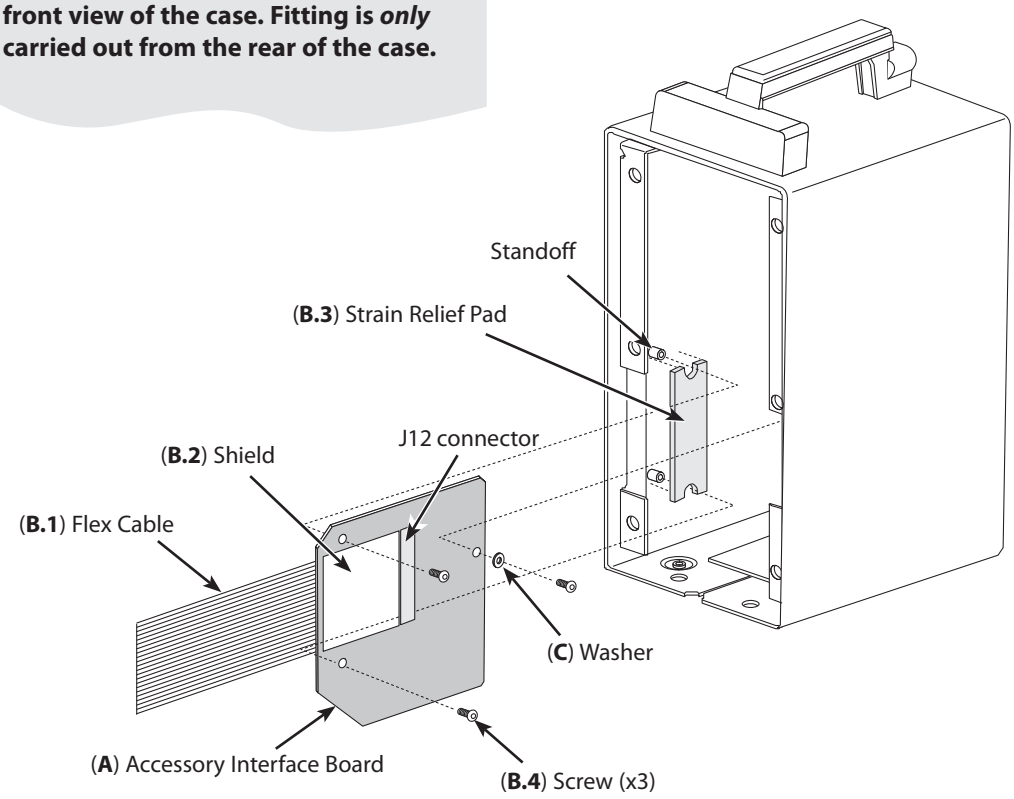
Body Assembly *(continued)*

Accessory Interface Board

Replacement Procedure

1. Unplug all cables connected to the Accessory Interface Board, including the flex cable (J12).
2. Using a right-angled Phillips screwdriver, remove the 3 screws and 1 washer securing the Accessory Interface Board to the case.
3. Withdraw the Accessory Interface Board from the body, removing the strain relief pad from between the case standoffs as necessary.
4. Reassemble in reverse order, referring to 'Refitting notes' on the next page.

To provide a clear view of the fitting area, the illustration below shows a front view of the case. Fitting is *only* carried out from the rear of the case.



- **If a strain relief pad (B.3) is not present, fit pad (145271) between the Accessory Interface Board and the case by positioning it between the mounting standoffs on the case**
- **Ensure that the shield (B.2) is the larger-size shield (141574) which covers all exposed leads in the path of the flex cable as shown below. Check the part number and replace existing shield as necessary**

Spare Parts

Item	Description	Part Number
A	ASSY,ACC INTFC BD,CAL,57X(BOM)	141590
B	KIT,STRAIN RELIEF/FLEX CBL,571/572	145272
B.1	FLEX CBL,RFI,571/572	139753 (Models XBX, XCX)
B.1	CBL,FLEX,56X/57X	140787 (Model XAX)
B.2	SHIELD,ACC INTFC BD,57X	141574
B.3	STRAIN RELIEF,CBL,57x	145271
B.4	SCREW,MACH 6-32X1/4 PNH PHH	300330
C	WSHR,INT TTH,.146X.283X.019,P	300389

Body Assembly *(continued)*

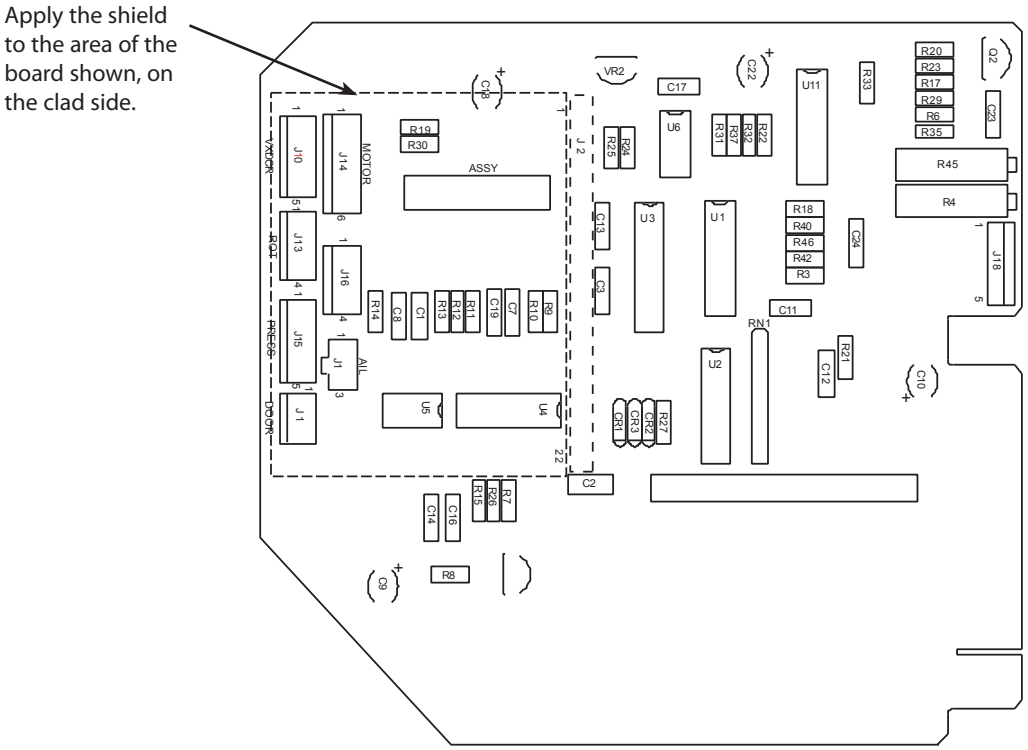
Accessory Interface Board *(continued)*

Refitting notes:

1) When refitting the flex cable, first carefully route the cable through the front panel and door grommets then connect it to J12 connector.

   It is important to firmly seat each pin into the connector using a birch stick (or equivalent tool or method), otherwise intermittent contact may occur resulting in Display errors

2) When refitting the Accessory Interface Board take care not to loosen the flex cable connection at J12 or to move the strain relief pad from its position between the standoffs.



Shield Location

Body Assembly *(continued)*

Separating the Front Panel Assembly from the Case

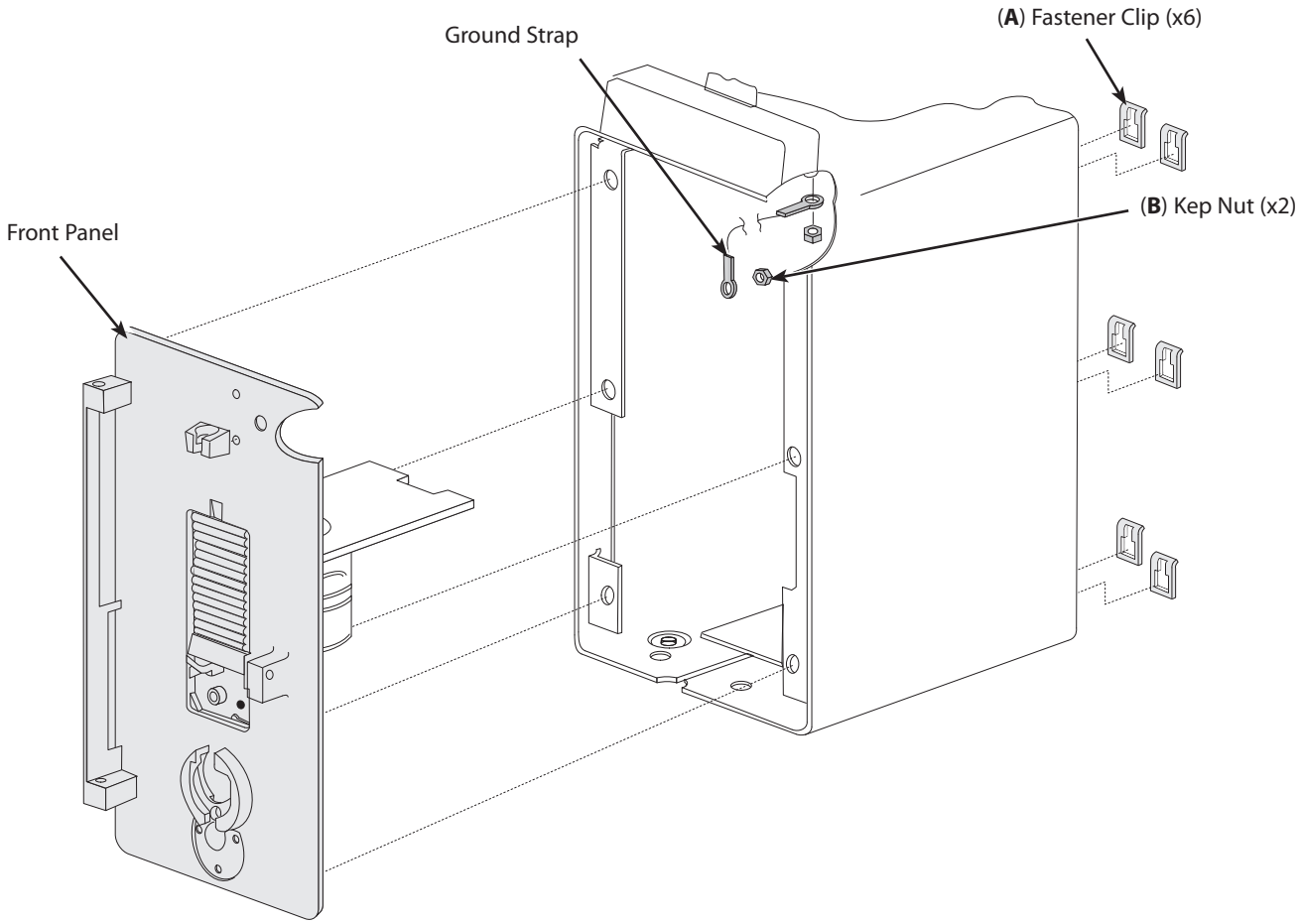
Replacement Procedure

1. Remove the two kep nuts securing the ground strap between the cover (inside top of case) and the front panel.
2. Unfasten the six retaining clips securing the front panel to the case. Separate the front panel assembly from the case.
3. Reassemble in reverse order.

Refitting note:

1) Use silicone (clear RTV coating, inner bond 140) around the case edge when refitting the front panel to the case.

To provide a clear view of the fitting area, the illustration below shows the door removed. The door is *not* serviceable.
If a replacement door is required, contact your local Cardinal Health Affiliate Office or Distributor for advice.



Spare Parts

Item	Description	Part Number
A	FSTNR,SPD NUT LKG 0.250 SSTUD	302902
B	NUT,KEP 6-32 S PL	300036

Body Assembly *(continued)*

Cover Assembly, Handle, Bumpers, Fastener Clips

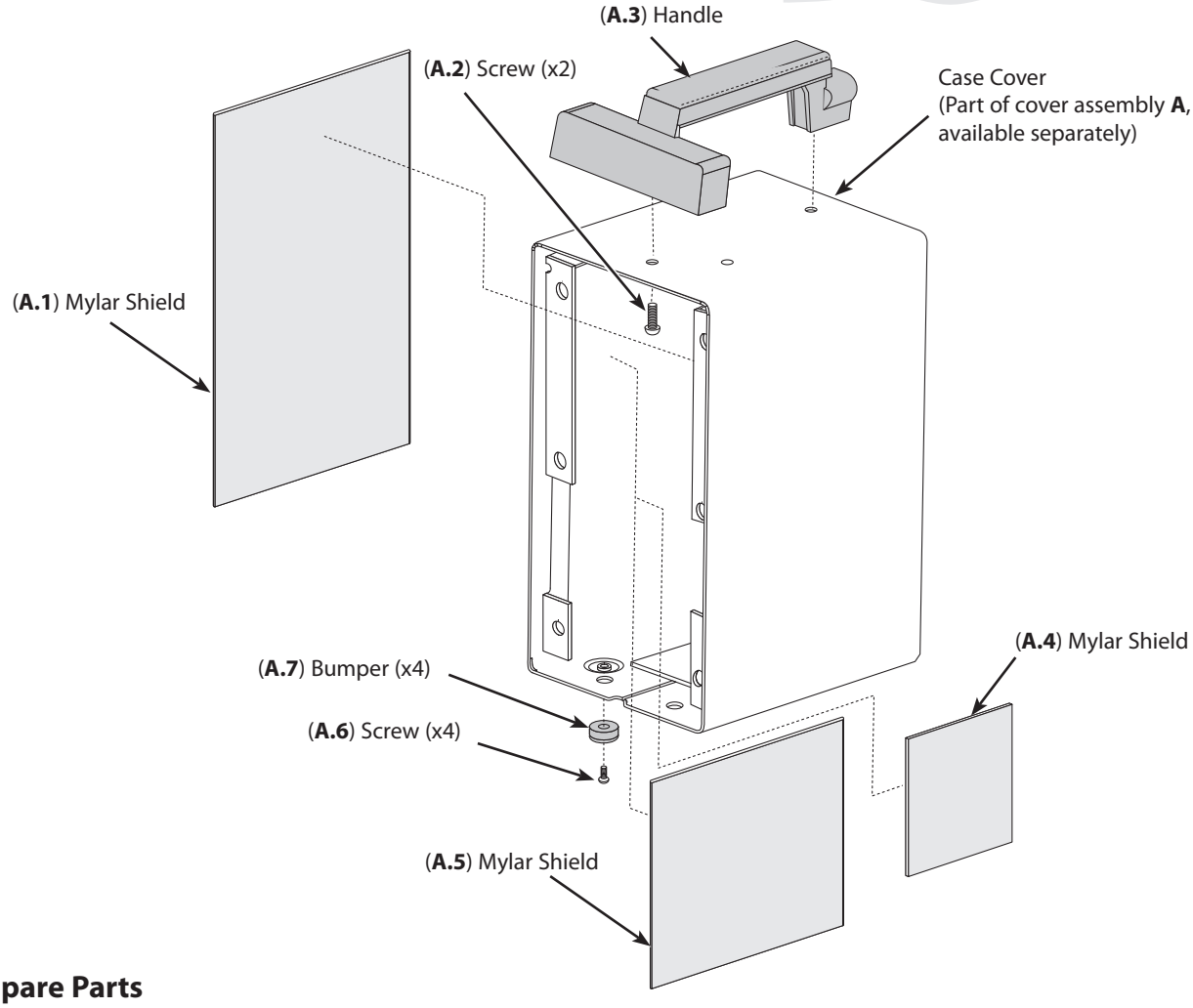
Replacement Procedure

1. Using a right-angled Phillips screwdriver, remove the two screws securing the handle to the case. Remove the handle.
2. Remove the four screws which secure the bumpers to the bottom of the case. Remove the bumpers.
3. Reassemble in reverse order.

Refitting note:

When refitting the handle, use adhesive on the two fixing screws.

To provide a clear view of the fitting area, the illustration below shows a front view of the case. Fitting is *only* carried out from the rear of the case.



Spare Parts

Item	Description	Part Number
A	KIT,COVER ASSY,CE,ENG,572	141555
A	KIT,COVER ASSY,CE,ITAL,571	141553
A	KIT,CVR ASSY,CE,SWED,571	136740
A.1	SHIELD,PW BD	125749
A.2	SCREW,MACH,8-32X3/8,PNH,PHH,S	304330
A.3	ASSY,HANDLE/CAP,57X(BOM)	134857
A.4	SHIELD,PW BD	125412
A.5	SHIELD,MYLAR,XFMR CASE,57X	129408
A.6	SCREW,MACH 6-32X1/4 PNH PHH	300330
A.7	BUMPER,MLD 2093 W/ST WSHR INS	301749

Door Assembly

Introduction

To replace the components within the door assembly, follow the instructions in the relevant sections of this chapter. These sections are:

- Separating the Chassis and the Body
- Bezel/Switch Panel, Display Board
- Pressure Plate
- Door Latch
- Door Latch Pin
- Air-In-Line Transmitter Assembly
- Set Sensor, Pressure Disc Plunger
- Pincher Cam Block

Important note: The Door and the Front Panel are *not* serviceable.

If replacement of these components is required, contact your local Cardinal Health Affiliate Office or Distributor for advice.

Bezel/Switch Panel, Display Board

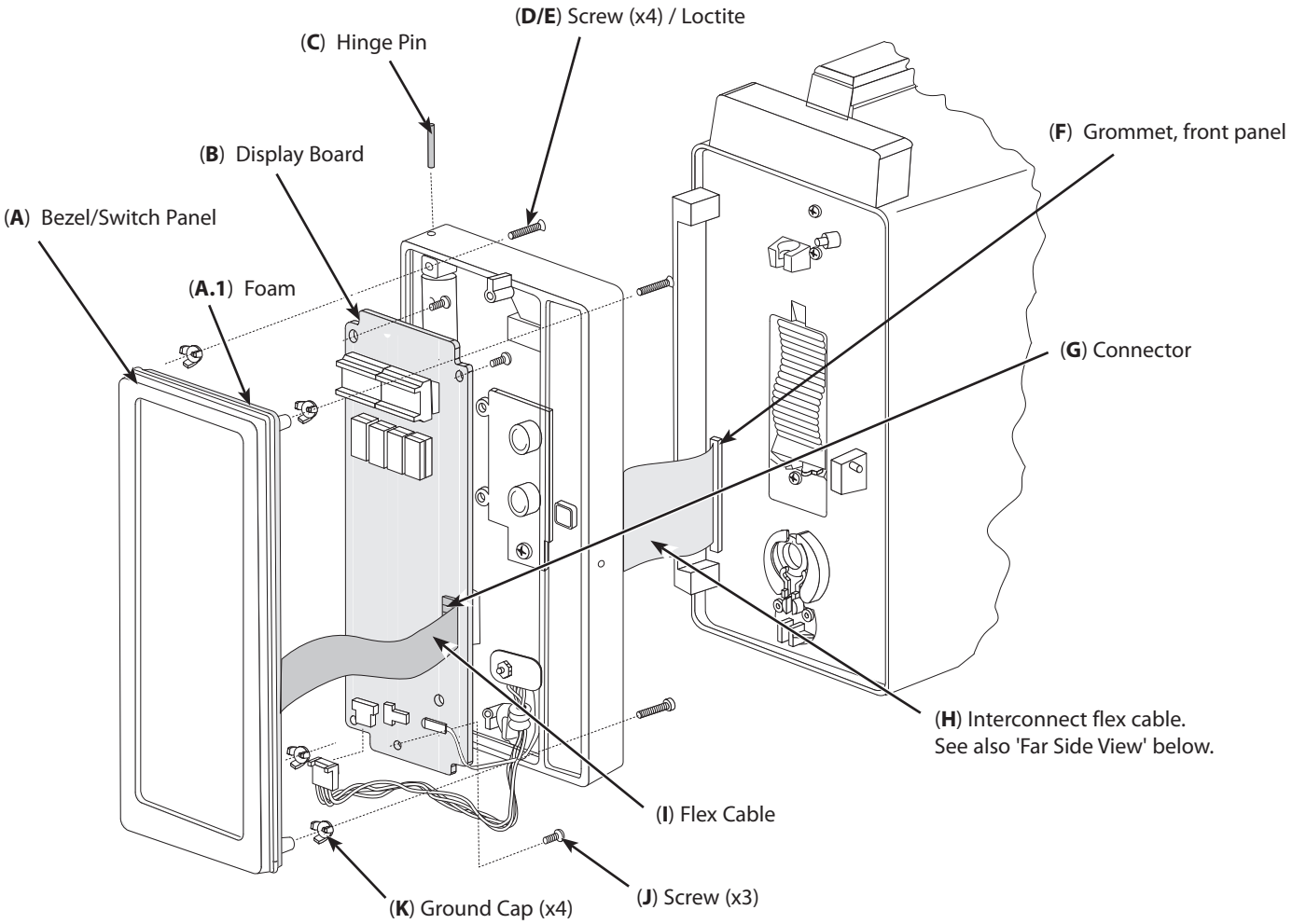
Replacement Procedure

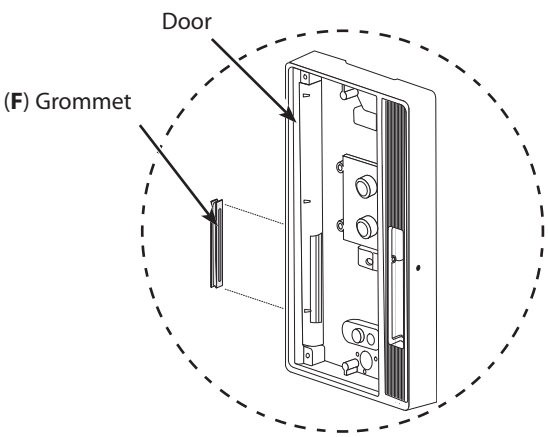
1. Remove the four screws securing the bezel/switch panel and Display Board to the door assembly.
2. Ease the bezel/switch panel and Display Board assembly away from the door until it is possible to disconnect the interconnect flex cable connector (**H**) from the back of the Display Board (J3).
3. Remove the four caps from the Bezel ground posts.
4. Remove the three screws securing the Display Board to the bezel/switch panel.
5. Carefully separate the Display Board and the bezel/switch panel then disconnect the flex cable connector (J2) from the Display Board.
6. Disconnect the set sensor cable harness connector (J1) and the air-in-line harness connector (J4) from the Display Board then remove the Display Board.
7. Remove the interconnect flex cable by sliding the cable out through grommets in the door and front panel.
8. Remove the mylar shield (**L**) from the Display Board as required.
9. Reassemble in reverse order.

Door Assembly *(continued)*

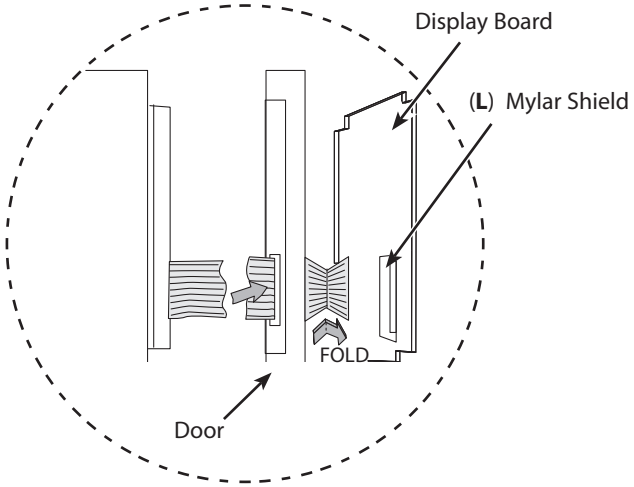
Bezel/Switch Panel, Display Board *(continued)*

To provide a clear view of the fitting area, the door is shown below removed from its hinges.
Important: Do not remove the door from its hinges for servicing or replacement purposes.
If the door is damaged or a replacement is required, contact your local Cardinal Health Affiliate Office or Distributor for advice.





Door Grommet



Far Side View

Door Assembly *(continued)*

Bezel/Switch Panel, Display Board *(continued)*

Refitting notes:

1) When refitting the Display Board, fold the interconnect cable as shown in the 'Far Side View' illustration (see previous page).
2) Use Loctite 243 on the four screws (**D**) which secure the bezel/switch panel and Display Board to the door assembly.
3) Adhere the mylar shield on the solder side of the Display Board, centered on, and against the edge of the interconnect cable connector, J3.
4) When refitting the interconnect flex cable carefully slide it through the front panel and door grommets. If necessary lightly grease the cable with lub grease 33 (0000ME00452), on a cotton swab. It is important to ensure any grease is wiped away from exposed cable using alcohol and lint-free cloth. If foreign matter remains, failure of the front panel/ Display Board may occur. See also 'Accessory Interface Board' for additional refitting notes.

Spare Parts

Item	Description	Part Number
A	ASSY,BEZEL/OVLY,ENG,571(BOM)	139002
A	ASSY,BEZEL/OVLY,ENG,572(BOM)	138999 (Models XBX, XCX)
A	ASSY,BEZEL/OVLY,FREN,571(BOM)	139000
A	ASSY,BEZEL/OVLY,DUT,571(BOM)	139001
A	KIT,BEZEL/OVLY,SPAN,571(BOM)	139003
A	KIT,BEZEL/OVLY,ITAL,571(BOM)	139004
A	ASSY,BEZEL/OVLY,SWED,571(BOM)	139005
A	KIT,BEZEL/OVLY,GER,571(BOM)	139006
A	SERV ASSY,BEZEL/OVLY,ENG,570	133207 (Model XAX)
A.1	FOAM,0.062TX0.125W GREY	302932
B	SERV ASSY,DSPL BD,57X(BOM)	139007
*	DSPL,7/SEG,ORANGE,COM CATH.400	302274 (DS3-6 on Display Board)
*	DIODE,LED,YEL,MV53154/HLMP3465	302762 (DS7,8 on Display Board)
*	DISPLAY,LED,RED,5X7 DOT MATRIX	303899 (DS1,2 on Display Board)
*	CONN,HDR,LTCH,4P,1X4,RA,AU	302797 (J1 on Display Board)
C	PIN,GRV 0.125X1.25 S ALLOY	302053
D	SCREW,CAP 4-40X5/8 HXSO	302466
E	ADHESIVE LOCTITE 243	0000ME00672
F	GROMMET,FLEX STRIP	125359
G	CONN,FL FLEX RTANG 11P 0.100C	303612
H	FLEX CBL,RFI,571/572	139753 (Models XBX, XCX)
H	CBL,FLEX,56X/57X	140787 (Model XAX)
J	SCREW,MACH 4-40X1/4 PNH PHH	300345
K	CAP,GROUND,POST,571/572	137653
L	SHIELD,MYLAR,56X/570	125413

* item not shown

Door Assembly *(continued)*

Pressure Plate

Replacement Procedure

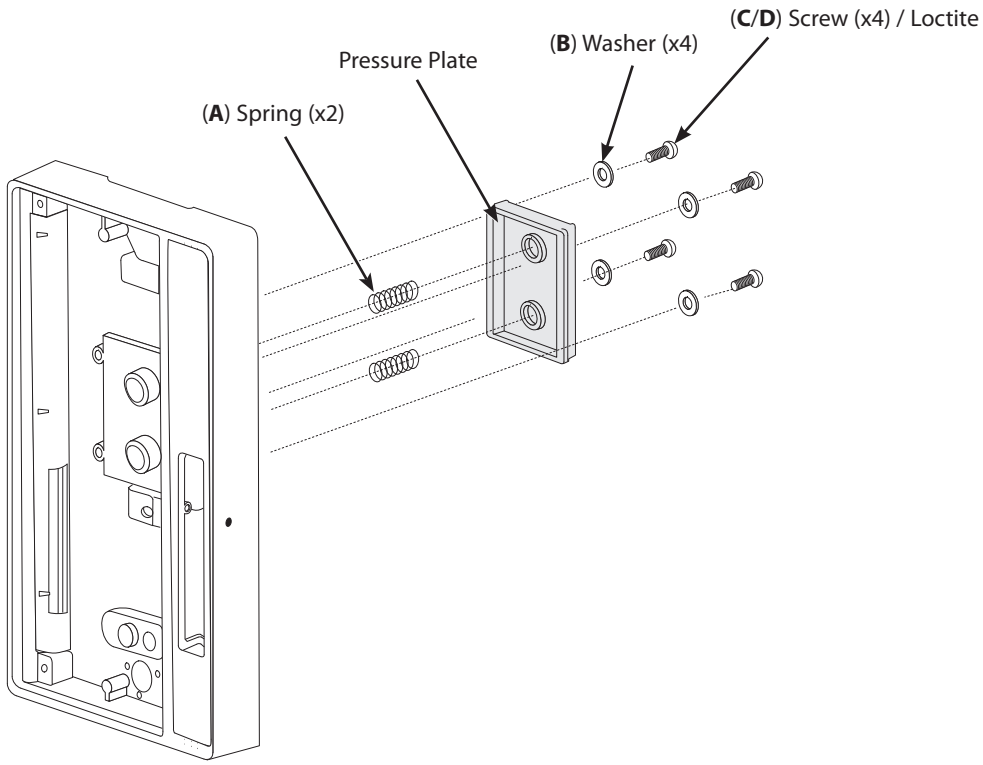
1. Mark the face of the pressure plate to ensure it can be refitted with the correct top side upwards.
2. Remove the four screws and washers securing the pressure plate to the door.
3. Remove the pressure plate and two coil springs seated in the door recesses.
4. Reassemble in reverse order.

Important:

- **Each pressure plate is mated to the cam followers during manufacture burn-in. If the pressure plate is damaged or a replacement is required, contact your local Cardinal Health Affiliate Office or Distributor for advice.**
- **Correct top-side-up orientation of the pressure plate must be observed when it is refitted.**

Refitting notes:

1) Install the pressure plate with the correct top side upwards using the mark made on face when removed.
2) Use Loctite 243 on screws when refitting the pressure plate.



Spare Parts

Item	Description	Part Number
A	SPR,CPRSN,.360X.813X.813X.035,MW	302900
B	WSHR,FL,.187X.438X.020,BLK,SS	301594
C	SCREW,MACH 8-32X3/8 PNH PHH	301522
D	ADHESIVE LOCTITE 243	0000ME00672

Door Assembly *(continued)*

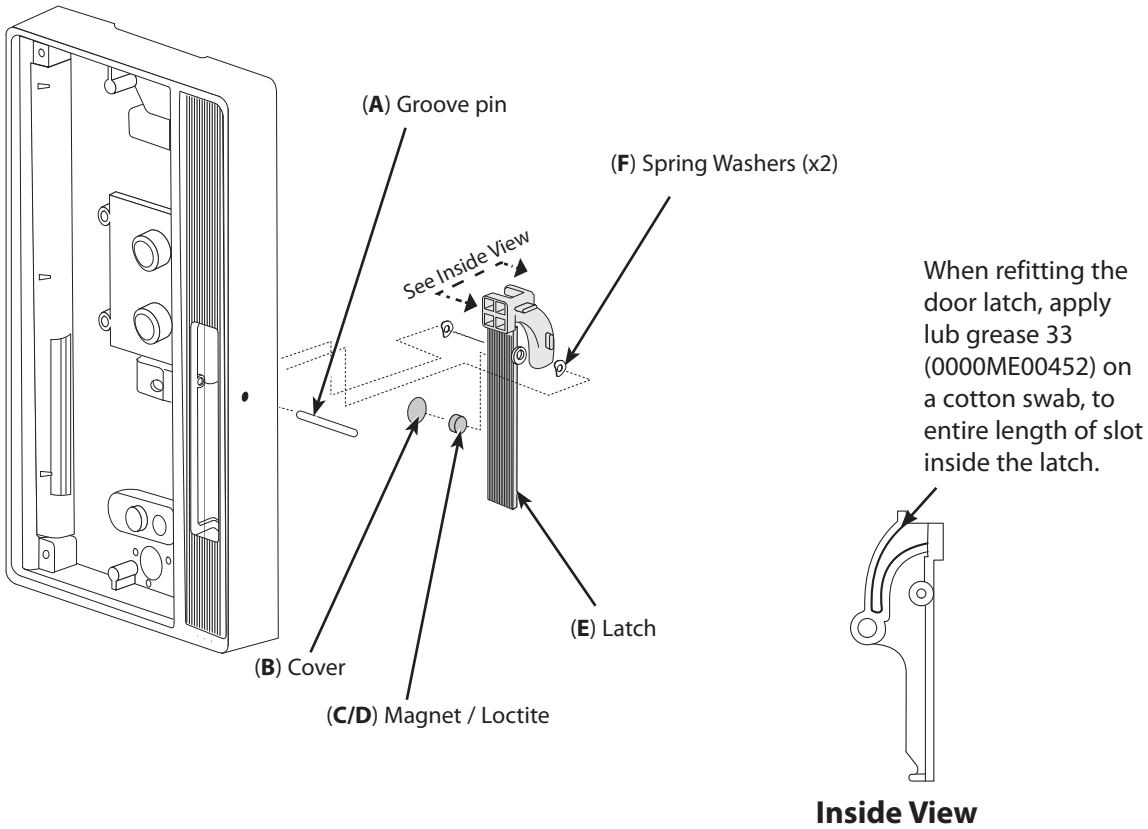
Door Latch

Replacement Procedure

1. Drive out the groove pin using a pin punch.
2. Remove the two curved spring washers and the door latch.
3. Remove the magnet cover and magnet as required.
4. Reassemble in reverse order.

Refitting notes:

1) When refitting the magnet, ensure the south pole faces outwards, secure magnet in place using loctite and cover.
2) Fit the two curved spring washers into the latch recesses outwardly, convex.
3) Fit the groove pin flush with the outside surface of the door.


(A) Groove pin
(F) Spring Washers (x2)
See Inside View
When refitting the door latch, apply lub grease 33 (0000ME00452) on a cotton swab, to entire length of slot inside the latch.
(E) Latch
(B) Cover
(C/D) Magnet / Loctite
Inside View

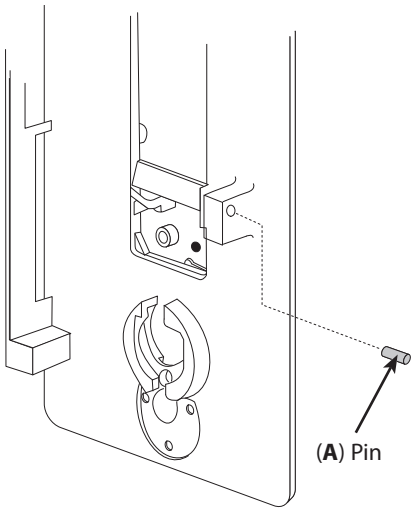
Spare Parts

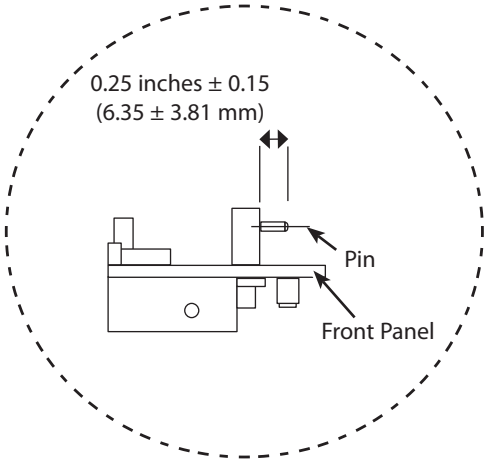
Item	Description	Part Number
A	PIN,GRV 0.125X1.25 S ALLOY	302053
B	COVER,MAGNET	125337
C	MAGNET,MAGNETIZED,CO 90C98A	302425
D	ADHESIVE LOCTITE 496	0000ME00753
E	ASSY LATCH,GNRC,(BOM)	132777
E	ASSY,LATCH,ENG,(BOM)	132776 (with label)
F	SPRING,CVR,WSHR U-138-0045S	301591

Door Assembly *(continued)*

Door Latch Pin

1. Pull out the old pin with pliers.
2. Reassemble in reverse order.



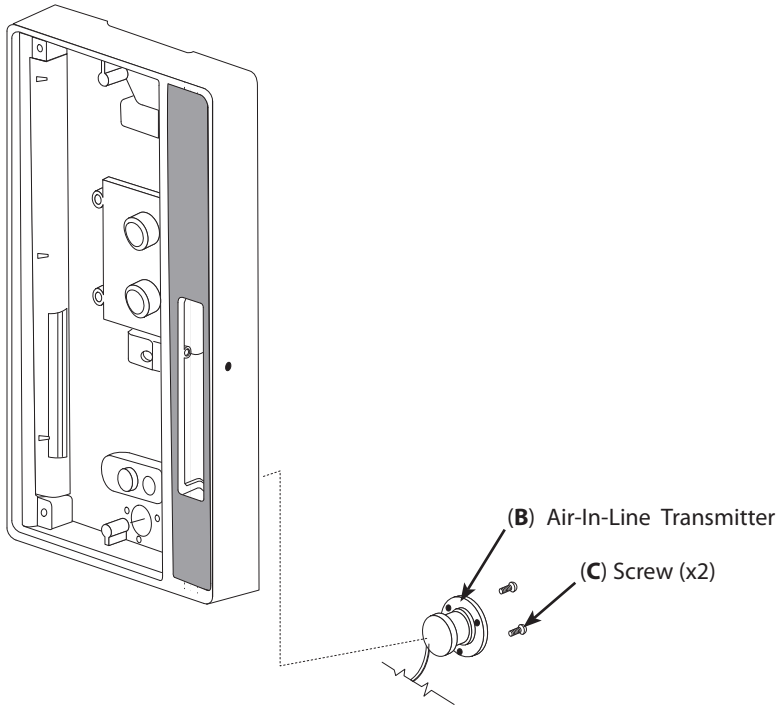


Refitting the Door Latch Pin

Air-In-Line Transmitter Assembly

Replacement Procedure

1. Disconnect the air-in-line cable harness connector (J4) from the Display Board.
2. Remove the two screws securing the air-in-line transmitter to the door.
3. Remove the air-in-line transmitter assembly by pulling it away from the door, drawing out the cable harness.
4. Reassemble in reverse order.



Spare Parts

Item	Description	Part Number
A	P,GRV 0.125X.500 REV TPR	302269
B	ASSY,AIL,TRANS,571/572(BOM)	137269
C	SCREW,CAP,4-40X1/4,BUTH,HXSO	304172

Door Assembly *(continued)*

Set Sensor, Pressure Disc Plunger

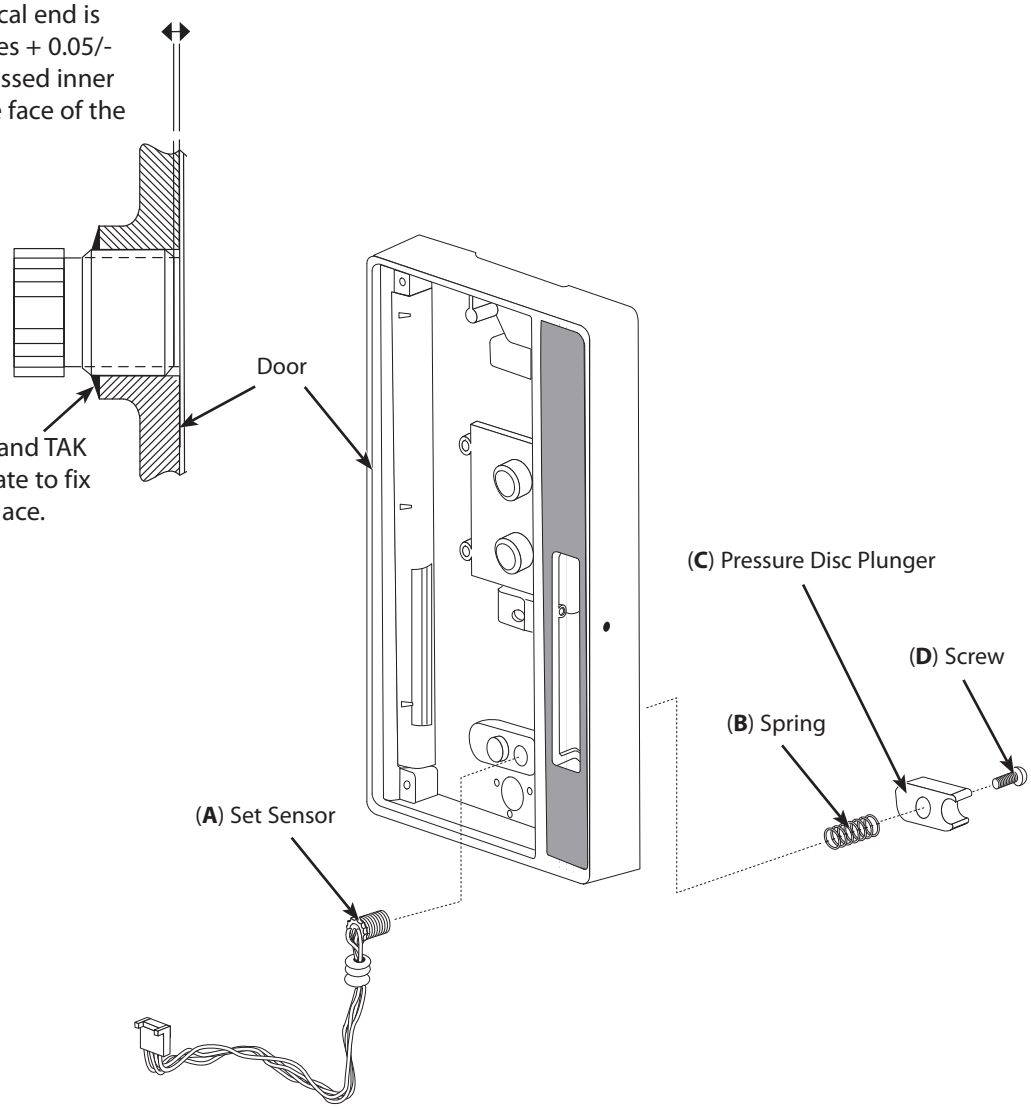
Replacement Procedure

1. Disconnect the set sensor assembly harness connector (J1) from the Display Board.
2. Grasp the body of the set sensor with pliers and turn anti-clockwise.
3. Break the set sensor assembly loose as it is glued in place.
4. Remove the one screw securing the pressure disc plunger.
5. Remove the pressure disc plunger and spring.
6. Reassemble in reverse order.

Refitting notes:

1) Thread the set sensor into the door until the optical end is recessed 0.25 inches + 0.05/-0.15 from the recessed inner circle on the inside face of the door.

2) Use Loctite 38050 and TAK PAK 11525 accelerate to fix the set sensor in place.



Spare Parts

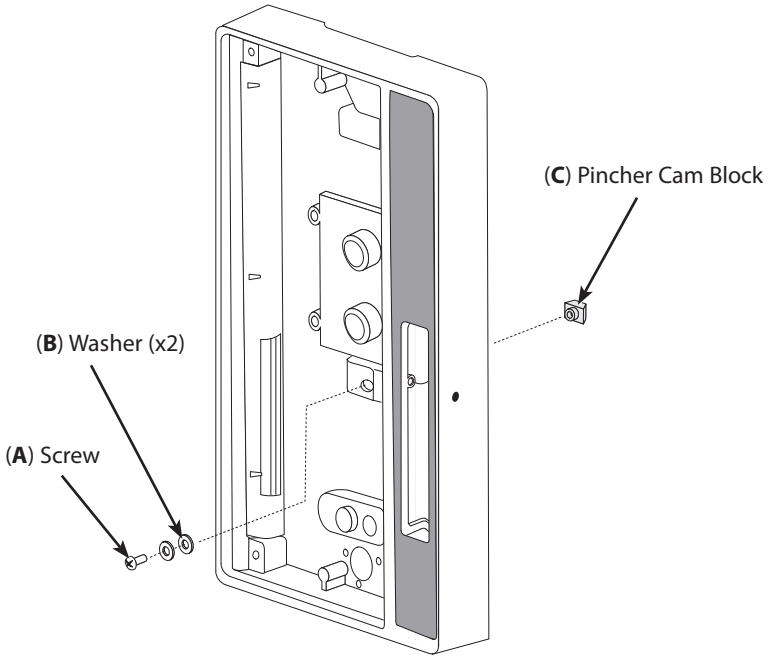
Item	Description	Part Number
A	ASSY,SET SNSR,571/572(BOM)	139019
B	SPRING,PLUNGER,56X/57X	133246
C	PLUNGER,PRESSURE,DISC,570XB	133132
D	SCREW,MACH 6-32X3/8 TR PHH	300701

Door Assembly *(continued)*

Pincher Cam Block

Replacement Procedure

1. Break loose and remove the one screw and two washers securing the pincher cam block, they are glued in place.
2. Remove the pincher cam block.
3. Reassemble in reverse order.



Refitting notes:

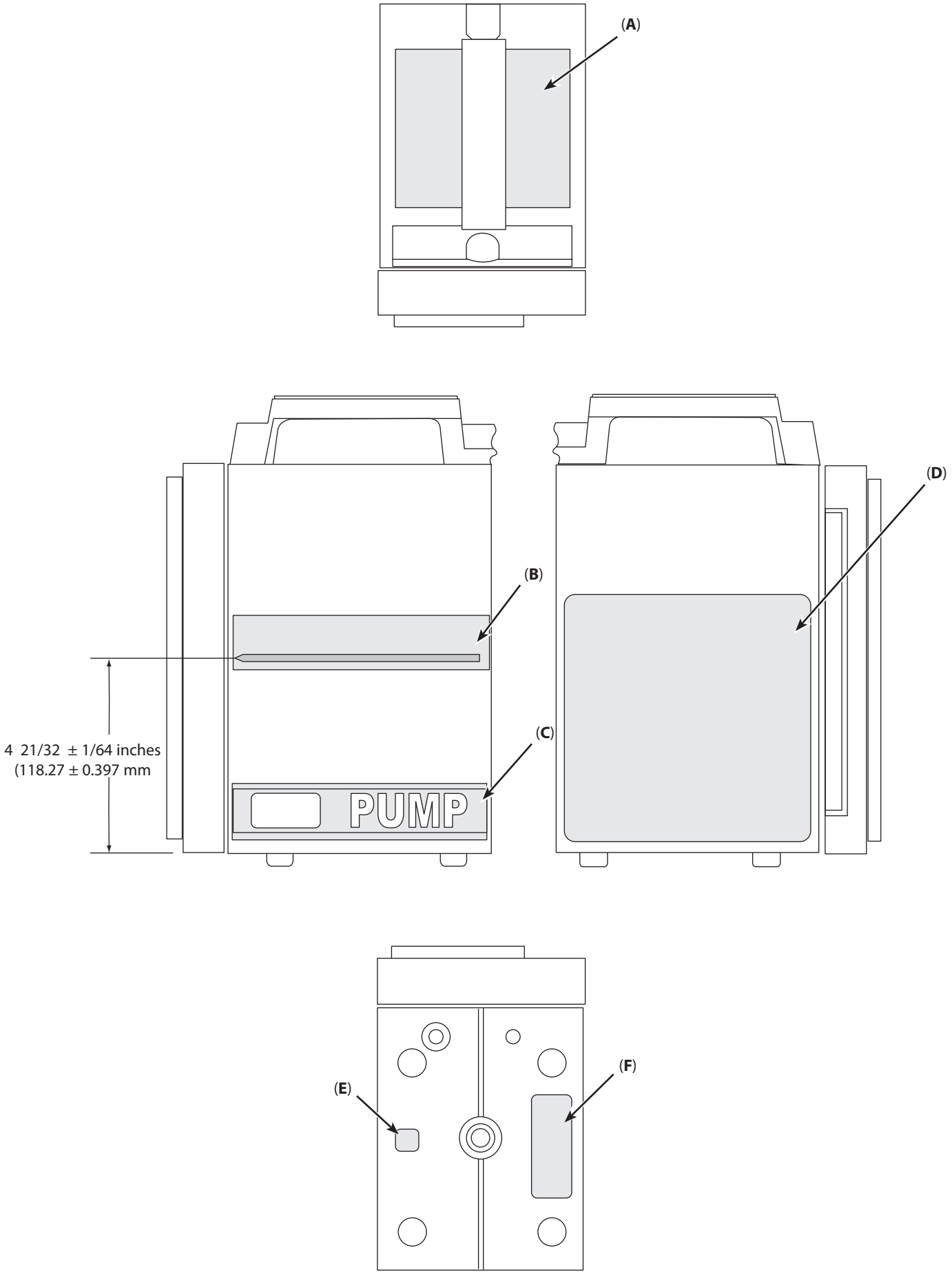
Fit and adjust the pincher cam block as follows:

1) Loosely secure the pincher cam block with the one screw and two washers.
2) Open the pump door and insert a 0.125" pin gauge in the clamp of the pincher mechanism on the front panel. The pin must sit vertically and the pin tip *must* sit below the pressure plate. Locating it any higher will result in inaccurate adjustment of the pincher cam block.
3) With the pincher cam block free to move but loosely held in place by the securing screw, close the pump door over the pin gauge. Slide the securing screw to the right until the pincher cam block rests solidly against the pincher then tighten the securing screw, taking care not to strip the plastic threads.
4) Apply Loctite 420 to the back of the door and around the pincher cam block. Allow to dry for a minimum of 10 minutes before removing the pin gauge.
5) Insert a 0.110" pin gauge in the clamp of the pincher mechanism on the front panel. The pin must sit vertically and the pin tip *must* sit below the pressure plate.
6) Close the pump door. Verify that the pin drops out of the pincher mechanism. If not, readjust the pincher cam block.

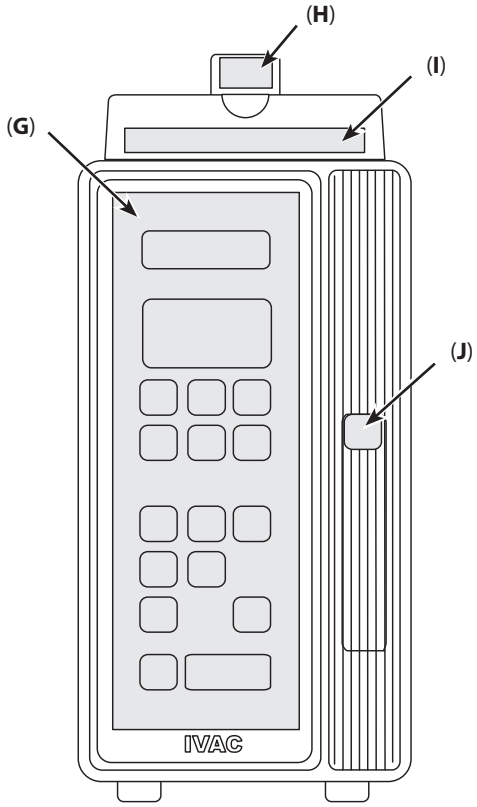
Spare Parts

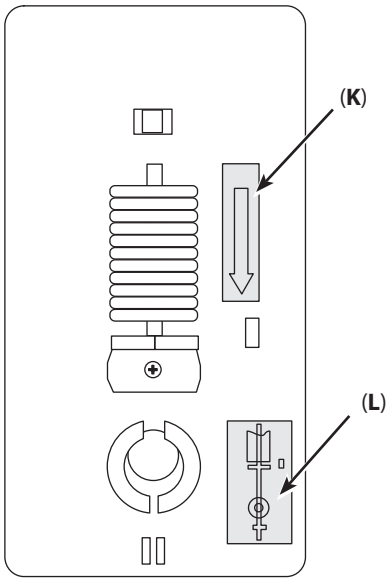
Item	Description	Part Number
A	SCREW,MACH 4-40X1/4 PNH PHH	300345
B	WSHR,FL,.4BA T2 ST/STA2	0000ME00310
C	PINCHER,CAM,56X/57X	125368

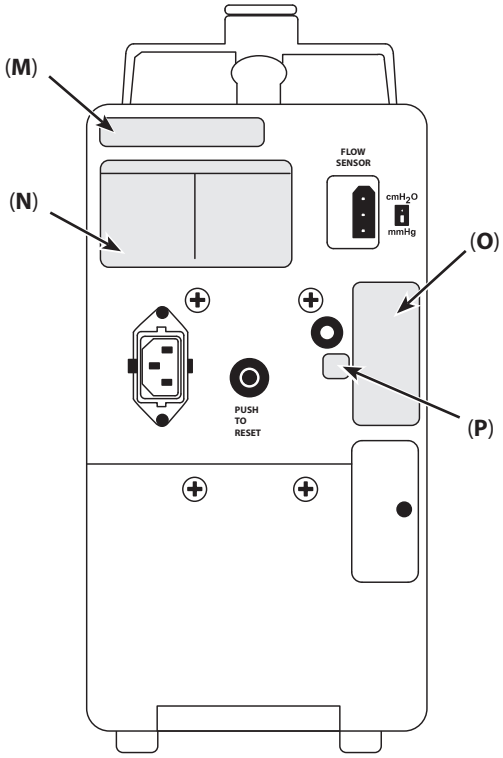
Labels

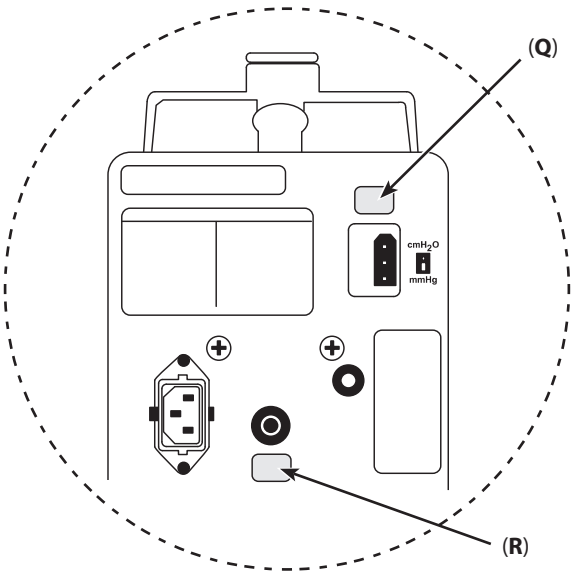


Labels *(continued)*









Note: English text is printed on the rear panel therefore labels (**Q**) and (**R**) are only required for other languages.

Labels *(continued)*

Spare Parts

Item	Description	Part Number
A	LBL,FLOW SNSR PLCMT,ENG,57X	132152
A	LBL FLOW SNSR PLCMT GER 571	135383
A	LBL,FLOW SNSR PLCMT,FREN,570/1	132712
A	LBL,FLOW SNSR PLCMT,DUT,571	137695
A	LBL FLOW SNSR PLCMT SWED 571	137693
A	LBL FLOW SNSR PLCMT SPAN 571	137694
A	LBL FLOW SNSR PLCMT ITAL 571	137692
B	LBL,PRES XDCR,ENG,57X(BOM)	133215
B	LBL,PRES XDCR,GER	125452.01
B	LBL,PRES XDCR,FREN	125452.02
B	LBL,PRES XDCR,SWED	125452.04
B	LBL,PRES XDCR,SPAN	125452.05
B	LBL,PRES XDCR,ITAL	125452.06
C	LBL,VPVP,ENG,572(BOM)	135990
C	LBL VPVP ENG 571 (BOM)	138658
C	LBL VPVP GER 571 (BOM)	135590
C	LBL VPVP FREN 571 (BOM)	135589
C	LBL,VPVP,DUT,571(BOM)	137658
C	LBL VPVP SWED 571 (BOM)	137651
C	LBL VPVP SPAN 571 (BOM)	137656
C	LBL VPVP ITAL 571 (BOM)	137649
D	LBL START UP ENG 571 (BOM)	138656
D	LBL,START-UP,ENG,572(BOM)	137463
D	LBL, START-UP, GER, 571 (BOM)	137841
D	LBL, START-UP, FREN, 571 (BOM)	137839
D	LBL,START-UP,DUT,571(BOM)	137329
D	LBL START UP SWED 571(BOM)	137646
D	LBL START UP SPAN 571(BOM)	137333
D	LBL START UP ITAL 571(BOM)	137642
E	LBL CE MARK INST MDD	136933
F	LBL,CAUT,ENG	125392
F	LBL,CAUT,GER	125407.01
F	LBL,CAUT,FREN	125407.02
F	LBL,CAUT,DUT	125407.03
F	LBL CAUT SWED	125407.04
F	LBL CAUT SPAN	125407.05
F	LBL CAUT ITAL	125407.06
G	ASSY,BEZEL/OVLY,ENG,572(BOM)	138999 (Models XBX, XCX)
G	SERV ASSY,BEZEL/OVLY,ENG,570	133207 (Model XAX)
G	ASSY,BEZEL/OVLY,ENG,571(BOM)	139002
G	KIT,BEZEL/OVLY,GER,571(BOM)	139006
G	ASSY,BEZEL/OVLY,FREN,571(BOM)	139000
G	ASSY,BEZEL/OVLY,DUT,571(BOM)	139001
G	ASSY,BEZEL/OVLY,SWED,571(BOM)	139005
G	KIT,BEZEL/OVLY,SPAN,571(BOM)	139003
G	KIT,BEZEL/OVLY,ITAL,571(BOM)	139004

Labels *(continued)*

Spare Parts

Item	Description	Part Number
H	LBL,HANDLE,UPR,572	135992
H	LBL HANDLE UPR 571	135539
I	LBL,HANDLE,LWR,ENG,57X	132394
I	LBL HANDLE LWR GER 571	135382
I	LBL, HANDLE, LWR, FREN, 57X	132713
I	LBL HANDLE LWR DUT 571(BOM)	137685
I	LBL HANDLE LWR SWED 571(BOM)	137683
I	LBL, HANDLE, LWR, SPAN, 571	137684
I	LBL HANDLE LWR ITAL 571(BOM)	137682
J	LBL,PRESS TO OPEN,ENG	125393
J	LBL,PRESS TO OPEN,GER	125451.01
J	LBL,PRESS TO OPEN,FREN,56X/57X	125451.02
J	LBL,PRESS TO OPEN,DUT	125451.03
J	LBL PRESS OPEN SWED	125451.04
J	LBL,PRESS TO OPEN,SPAN	125451.05
J	LBL PRESS OPEN ITAL	125451.06
K	LBL,FLOW ARROW,ENG	125497
K	LBL,FLOW ARROW,GER	125450.01
K	LBL,FLOW ARROW,FREN,56X/57X	125450.02
K	LBL,FLOW ARROW,DUT	125450.03
K	LBL FLOW ARROW SWED	125450.04
K	LBL FLOW ARROW SPAN	125450.05
K	LBL FLOW ARROW ITAL	125450.06
L	LBL,TBG POSN,57X	133208
L	LBL TBG POSN GER 571	135386
L	LBL,TBG,POSN,FR/CAN,570	133430
L	LBL TBG POS DUT 571(BOM)	137690
L	LBL TBG POS SWED 571(BOM)	137688
L	LBL TBG POS SPAN 571(BOM)	137689
L	LBL TBG POS ITAL 571(BOM)	137687
M	LBL,S/N RPLCMNT	125569
N	LBL,NAME RATING,ENG,571/572	137496
N	LBL,NAME RATING,FREN,571	137960
N	LBL,NAME RATING,DUT,571	137847
N	LBL NAME RATING SWED 571	137648
N	LBL NAME RATING SPAN 571	137848
N	LBL NAME RATING ITAL 571	137644
O	LBL,PATENT NTC,571/572	137854
P	LBL,EQ POT CONN	133318

Labels *(continued)*

Spare Parts

Item	Description	Part Number
Q	LBL,FLOW SNSR,GER	125406.01
Q	LBL,FLOW SNSR,FREN	125406.02
Q	LBL,FLOW SNSR,DUT	125406.03
Q	LBL FLOW SNSR SWED	125406.04
Q	LBL FLOW SNSR SPAN	125406.05
Q	LBL FLOW SNSR ITAL	125406.06
R	LBL PUSH TO RESET GER 571	137476
R	LBL,PUSH TO RESET,FREN,571	137475
R	LBL,PUSH TO RESET,DUT,571	137330
R	LBL PUSH TO RESET SWED 571	137645
R	LBL PUSH TO RESET SPAN 571	137845
R	LBL PUSH TP RESET ITAL 571	137641
*	LBL, WEEE Symbol	10012829

* item not shown

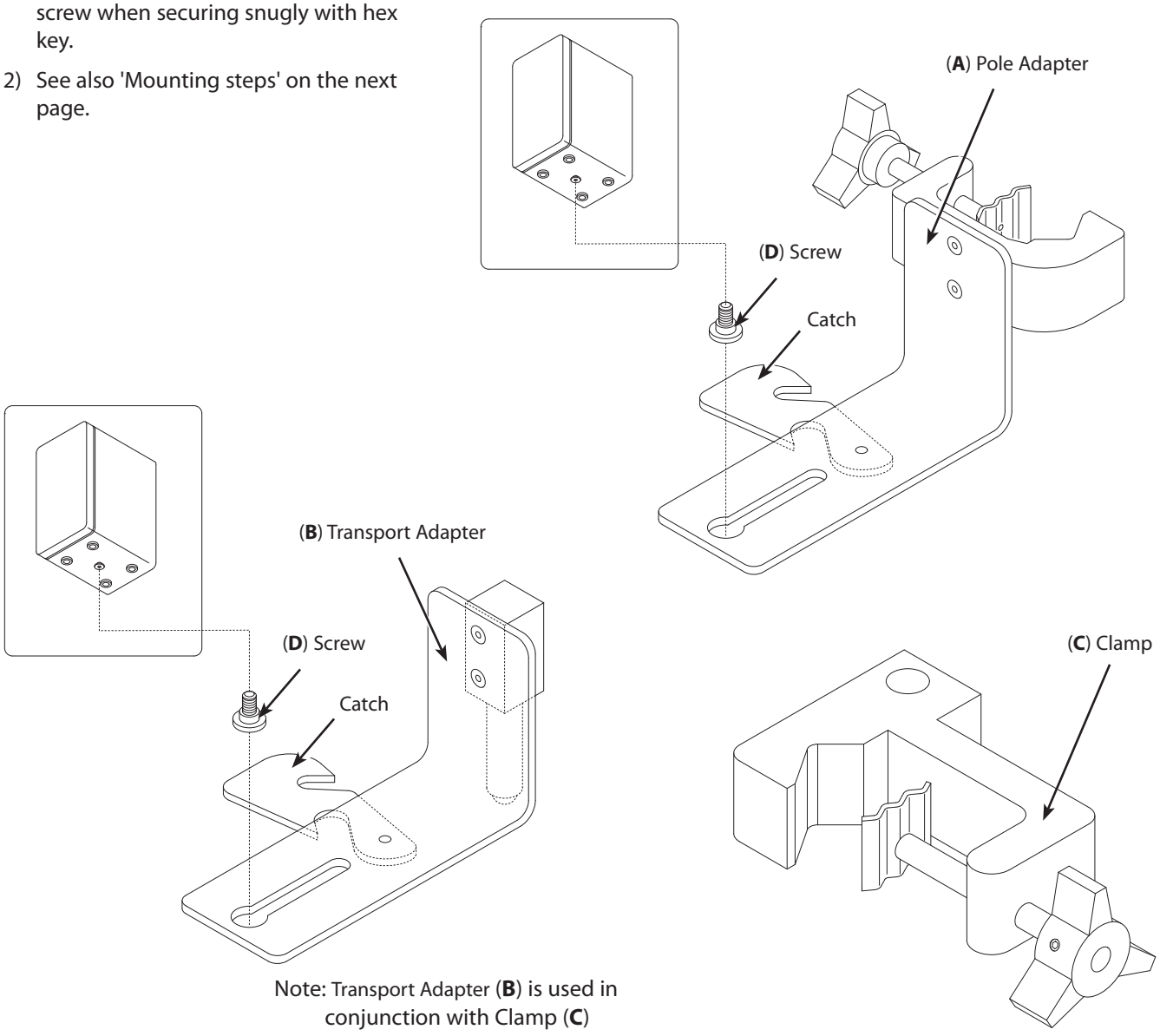
Pole Clamp Assembly

Replacement Procedure

1. Referring to the 'Mounting steps' 1 and 2 on the next page, unlock the catch, levering it open with a blunt object such as a coin if necessary.
2. Push the adapter bracket away from the backstop to release it then lift the pole clamp adapter up and off the screw to remove it.
3. Using a hex key, loosen the one fixing screw at the bottom centre of the pump. Remove the screw.
4. Reassemble in reverse order.

Refitting notes:

1) Do not over-tighten the one fixing screw when securing snugly with hex key.
2) See also 'Mounting steps' on the next page.



Note: Transport Adapter (**B**) is used in conjunction with Clamp (**C**)

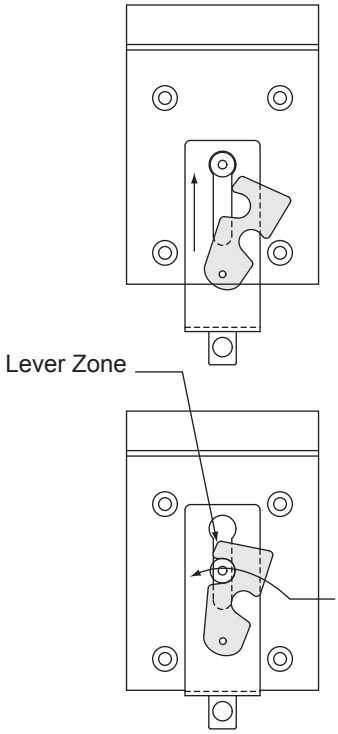
Spare Parts

Item	Description	Part Number
A	POLE ADAPTER	6767
B	TRANSPORT ADAPTOR WC	5767C
C	IV POLE CLAMP ACCESORY	BC100A
D	POLE CLAMP HEX SCREW 56X/57X	SCR-1347

Pole Clamp Assembly *(continued)*

Mounting steps:

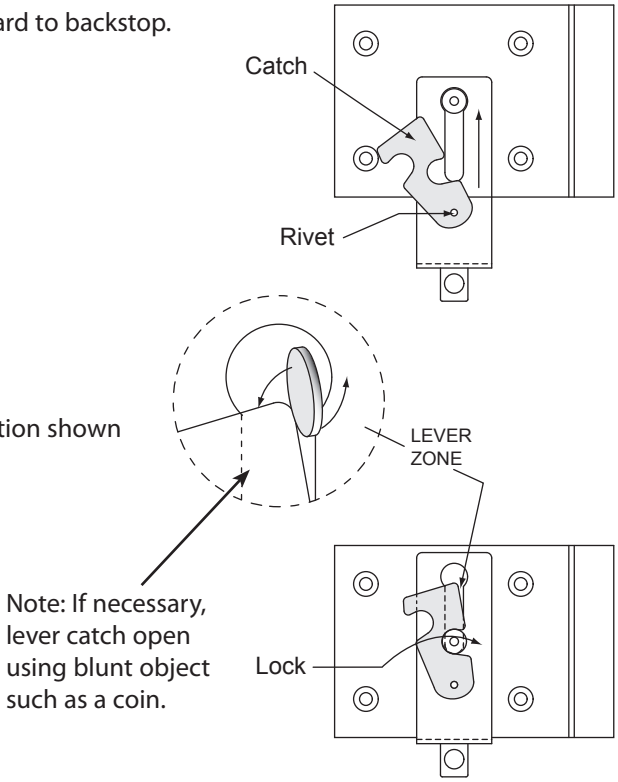
1) Push bracket forward to backstop.



Back Mount

Note: Use catch mouth ***furthest position*** from rivet

2) Push catch in direction shown to lock position.



Note: If necessary, lever catch open using blunt object such as a coin.

Side Mount

Important note: Use catch mouth ***nearest position*** from rivet.

Bottom Views

Appendix A

Specifications

In this chapter

Infusion	**84**
Electrical	**84**
Physical	**84**
Environmental	**84**
Electromagnetic Compatibility	**85**

The following information is for reference purposes only. For more detailed specifications refer to relevant *DFU*.

Infusion

Rate range	1 to 999 ml/h	STANDARD RATE range
	0.1 to 999.9 ml/h	ALL RATE range, with user selectable maximum rate
Volume infused range	0.1 to 9999.9 ml/h	
KVO rate	5.0 ml/h or at current set rate whichever is less	

Critical volume	Maximum incremental volume delivered in case of failure will not exceed 8.75 ml
System Accuracy	±5%
Infusion Set	IVAC "52" Series Volume Infusion sets
Occlusion pressure	Maximum: 500 mmHg (680 cmH_20)
Mode of operation	Continuous

Electrical

Battery type	Lead acid, sealed, rechargeable. Automatically charges when the pump is connected to AC power
Battery life	5 hours @ 125 ml/h with a fully charged, new battery
Battery recharge time	Approximately 24 hours from discharge to 100% charge
Power requirements	220 to 240V AC; 50/60 Hz; 0.25A; 3-wire grounded system
Memory retention	At 25°C, with a fully charged, new battery, the volatile memory configuration information will be retained for at least 6 months
Ground current leakage	Maximum 100µA rms (ungrounded) at 220 Vrms to meet EN/IEC 60601-1
Protection against electrical shock hazards	Class I

Physical

Weight	Approximately 6.5 kg		
Case material	Blue enameled aluminium		
Dimensions	**W**	**H**	**D**
	12.7 cm	29.2 cm	19.3 cm

Environmental

IPX rating	IPX1		
	Temperature	**Relative humidity**	**Atmostpheric pressure**
Operating limits	+5°C to +40°C	20% to 90% non-condensing	700 - 1060 hPa
Transport/storage limits	-40°C to +60°C	10% to 100%	500 - 1060 hPa

Electromagnetic Compatibility

Warning:

- The use of any accessory, transducer, or cable with the IVAC® Volumetric Pump other than those specified may result in increased emissions or decreased immunity of the pump.
- The IVAC® Volumetric Pump should not be used adjacent to or stacked with other equipment, however if adjacent or stacked use is necessary, the IVAC® Volumetric Pump should be observed to verify normal operation in the configuration in which it will be used.

Caution:

- The IVAC® Volumetric Pump is a CISPR 11 Group 1 Class A Medical Equipment System and intended for use by healthcare professionals only.
- Medical Electrical Equipment needs special precautions regarding EMC and needs to be installed, put into service and used according to the EMC information provided in the accompanying documents.
- Portable and Mobile RF communications can affect Medical Electrical Equipment.
- Operating the pump near equipment which radiates high energy radio frequencies (electro surgical or cauterizing equipment, portable radios, cellular telephones, etc.) may cause false alarm conditions. If this happens, reposition the pump away from the source of interference or turn off the pump and manually regulate the flow.

Guidance and Manufacturer's Declaration – Electromagnetic Emissions		
The IVAC® Volumetric Pump is intended for use in the electromagnetic environment specified below. The customer or the user of the IVAC® Volumetric Pump should assure that it is used in such an environment.		
Emissions Test	**Compliance**	**Electromagnetic Environment – Guidance**
CISPR 11 RF Emissions	Group 1	The pump uses RF energy only for its internal function in the normal product offering. Therefore, its RF emissions are very low and are not likely to cause any interface in nearby electronic equipment.
CISPR 11 RF Emissions	Class A	The pump is suitable for use in all establishments, other than domestic, and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
EN 61000-3-2 Harmonic Emissions	Class A	
EN 61000-3-3 Voltage Fluctuations, Flicker Emissions	Complies	

Important: The IVAC® Volumetric Pump has been assessed to the following standards;
EN/IEC 60601-1-2:1993 (Models 571XAX, 572XAX & 572XBX)
EN/IEC60601-1-2:2001 (Models 571XBX & 572XCX).

Electromagnetic Compatibility *(continued)*

Guidance and Manufacturer's Declaration - Electromagnetic Immunity			
The IVAC® Volumetric Pump is intended for use in the electromagnetic environment specified below. The customer or the user of IVAC® Volumetric Pump should assure that it is used in such an environment.			
Immunity Test	**EN 60601-1-2 Test Level**	**Compliance Level**	**Electromagnetic Environment – Guidance**
EN 61000-4-2 Electro-Static Discharge (ESD)	±6 kV contact ±8 kV air	±8 kV contact (Note 2) ±15 kV air (Note 2)	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
EN 61000-4-4 Electrical Fast Transient, Burst (EFT) (Note 3)	±2 kV for power supply lines ±1 kV for input/ output lines	±2 kV for power supply lines N/A (Note 4)	Mains power quality should be that of a typical commercial or hospital environment.
EN 61000-4-5 Power Line Surge (Note 3)	±1 kV Line(s) to Line(s) ±2 kV Line(s) to Earth	±1 kV Line(s) to Line(s) ±2 kV Line(s) to Earth	Mains power quality should be that of a typical commercial or hospital environment.
EN 61000-4-8 Power Frequency Magnetic Field (50/60 Hz)	3 A/m	400 A/m 50 Hz (Note 2)	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
EN 61000-4-11 Voltage Dips, Short Interruptions, and Voltage Variations (Note 3)	<5 % U_T (Note 1) (>95 % dip in U_T) for 0.5 cycle	<5 % U_T (>95 % dip in U_T) for 0.5 cycle	Mains power quality should be that of a typical commercial or hospital environment. If the user of the pump requires continued operation during power mains interruptions, it is recommended that the pump be powered from an uninterruptible power supply or a battery. The pump does employ an internal short duration battery.
	40 % U_T (60 % dip in U_T) for 5 cycles	40 % U_T (60 % dip in U_T) for 5 cycles	
	70 % U_T (30 % dip in U_T) for 25 cycles	70 % U_T (30 % dip in U_T) for 25 cycles	
	<5 % U_T (>95 % dip in U_T) for 5 sec	<5 % U_T (>95 % dip in U_T) for 5 sec	

Note 1—U_T is the AC mains voltage prior to application of the test level.
Note 2—Compliance levels raised by EN 60601-2-24.
Note 3—Performed at the Minimum and Maximum Rated Input Voltage.
Note 4—Cardinal Health recommends using signal cables of less than 3 meters in length and this requirement is applicable only if signal cables are 3 meters or more in length. (EN 60601-1-2:2002, Clause 36.202.4)

Electromagnetic Compatibility *(continued)*

Guidance and Manufacturer's Declaration—Electromagnetic Immunity
LIFE SUPPORT Equipment

The IVAC® Volumetric Pump is intended for use in the electromagnetic environment specified below.
The customer or the user of the IVAC® Volumetric Pump should ensure that it is used in such an environment.

Immunity Test	EN 60601-1-2 Test Level	Compliance Level	Electromagnetic Environment – Guidance
EN 61000-4-6 Conducted RF	3 V rms 150 kHz to 80 MHz	10 V rms (Note 3)	Portable and mobile RF communications equipment should be used no closer to any part of the pump, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended Separation Distance** $d = [\frac{3.5}{V_1}]\sqrt{P}$ $d = [\frac{12}{V_2}]\sqrt{P}$ 80 MHz to 800 MHz $d = [\frac{12}{E_1}]\sqrt{P}$ 80 MHz to 2.5 GHz $d = [\frac{23}{E_1}]\sqrt{P}$ 800 MHz to 2.5 GHz where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m).[a] Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, [b] should be less than the compliance level in each frequency range. [c] Interference may occur in the vicinity of equipment marked with the following symbol:
EN 61000-4-3 Radiated RF	3 V/m 80 MHz to 2.5 GHz	10 V/m (Note 3)	

Note 1—At 80 MHz and 800 MHz, the higher frequency range applies.

Note 2—These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

Note 3—Compliance levels raised by EN 60601-2-24.

a The compliance levels in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2.5 GHz are intended to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into patient areas. For this reason, an additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in these frequency ranges.

b Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast, and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the pump is used exceeds the applicable RF compliance level above, the pump should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the pump.

c Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 10 V/m.

Electromagnetic Compatibility *(continued)*

Recommended Separation Distances for LIFE SUPPORT Equipment between portable and mobile RF communications equipment and the IVAC® Volumetric Pump

The IVAC® Volumetric Pump is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled.

The user of the IVAC® Volumetric Pump can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the IVAC® Volumetric Pump as recommended below, according to the maximum output power of the communications equipment.

Rated Maximum Output Power of Transmitter W	**Separation Distance According to Frequency of Transmitter** m			
	150 kHz to 80 MHz Outside ISM bands 3.5 $d = [\text{------}] \sqrt{P}$ $V1$	**150 kHz to 80 MHz In ISM bands** 12 $d = [\text{------}] \sqrt{P}$ $V2$	**80 MHz to 800 MHz** 12 $d = [\text{------}] \sqrt{P}$ $E1$	**800 MHz to 2.5 GHz** 23 $d = [\text{------}] \sqrt{P}$ $E1$
0.01	0.03	0.12	0.12	0.23
0.1	0.11	0.38	0.38	0.73
1	0.35	1.20	1.20	2.30
10	1.11	3.80	3.80	7.28
100	3.50	12.00	12.00	23.00

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be determined using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

Note 1—At 80 MHz and 800 MHz, the separation distance for the higher frequency range apply.
Note 2—The ISM (Industrial, Scientific, and Medical) bands between 150 kHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz.
Note 3—An additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2.5 GHz to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into patient areas.
Note 4—These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

Appendix B

Spare Parts Listing

In this chapter

Chassis Assembly Parts	**90**
Body Assembly Parts	**91**
Door Assembly Parts	**92**
Software	**93**
Labels	**94**
Test Equipment & Accessories	**96**

Chassis Assembly Parts

Part Number	Description
123273	LBL,GND SYM
125318	HSG,BATT,56X/57X
125382	RETAINER,REC
125383	RETAINER,PW BD
125389	ADPT,LINE FILTER,56X/57X/220V
125425	ASSY,SPEAKER,56X/57X(BOM)
125429	ASSY,HARN,BATT,56X/570(BOM) (Model XAX)
10014086	ASSY,CABLE,FLAT,56X/57X(BOM)
125436	ASSY,HARN,DP SNSR REC,56X/57X (Model XAX)
132412	BATT PACK,26X/56X/57X
132626	HARN,INTCN,570 (Model XAX)
136331	ASSY, HARN, BATT, RFI, 56X/57X BOM (Model XBX, XCX)
136730	SHIELD,BATT COVER,571/572 (Model XCX)
136853	KIT,CE PANEL,571/2 (Model XBX, XCX)
137032	ASSY,FLOW SNSR BD,571/572 (Models XBX, XCX)
137441	BREAKER,CIRCUIT,571/572
137503	COVER,ACCESS,BATT,571/572
137715	COVER,CONN ACCESS,56X/57X
137851	ASSY, PANEL REAR ,RFI,571/572XB (Model XBX, XCX)
139009	ASSY,XFMR,220V 571/572(BOM)
139435	HARN,INTC,FOLDED,571/572 (Model XBX, XCX)
139865	SERV ASSY,LGC BD,571/2(BOM)
139866	ASSY,ANLG BD,CAL,571/2(BOM)
139867	ASSY,PWR REG BD,CAL,56X/57X
145071	SERV ASSY,MEM,REV3.01,570(BOM)
300034	SCREW,MACH 6-32X3/8 PNH PHH
300036	NUT,KEP 6-32 S PL
300037	WSHR,SPLIT,.168X.296X.040,PS
300038	WSHR,FL,.174X.380X.032,PS
300360	CREW,MACH 6-32X3/4 PNH PHH
300369	SCREW,MACH 8-32X3/8 PNH PHH
0000ME00310	WSHR,FL,.4BA T2 ST/STA2
301126	SCREW,MACH 8-32X1 1/2 PNH PHH
301407	SCREW,TPG 6-20X3/8 BI PHH
301632	IC,4013B CMOS FL/FL 14 DIP
301828	SCREW,MACH 6-32X1/2 PNH PHH
302123	IC,4093B CMOS 2-IN NAND 14 DIP
302155	XTAL,QTZ 2.29376 MHZ
302196	IC,TL494 VOLT REG 16 DIP
302206	IC,CA3240 BIMOS OP AMP 8 DIP
302369	IC,LM393N VOLT COMP 8 DIP
302561	STDOFF,HEX 6-32X7/16 AL ALY

Chassis Assembly Parts *(continued)*

Part Number	Description
303145	IC,74HC273 20 DIP D FL-FL
303164	CLIP,FUSE PC/TABS 0.250 DIA
303425	FUSE,SUB-MINI 5A 125V
303447	SCREW,6-20X7/8 PHN PHH
303636	IC,27C512,EPROM UV,512K 28 DIP
303639	IC,RAM,8KX8,CMOS,28 DIP
303734	CONN,PLUG 0.984 MTG STUD
303736	WSHR,FL,M 6,BRASS,NICKEL PLT
303737	WASHER,EXT T LKG,6MM,CS CAD PL
303739	WSHR,COLOR CODE,YEL/GRN,NPS
303740	NUT,HEX METRIC, M6, 5MM THK
303742	NUT,HEX 6MM METRIC,3.2MM THK
303863	IC,93C46,SERIAL EEPROM,8 DIP
303866	IC,82C54,CMOS,COUNTER,24 DIP
303867	IC,80C85A-2,MICROPROCESSOR,40D
303910	FUSE,1.5A,250V,NORM-BLO
304746	FILTER,EMI,LINE,120/250,1A

Body Assembly Parts

Part Number	Description
125321	COVER,PINCHER,56X/57X(BOM)
125412	SHIELD,PW BD
125445	ASSY,HARN,ROTN SNSR,56X/57X
125749	SHIELD,PW BD
125768	SPRING,CAM,56X
129408	SHIELD,MYLAR,XFMR CASE,57X
131002	ASSY,TIMING PULLEY,57X(BOM)
10013683	MOTOR 4-WIRE 56X57X
132536	ASSY,DOOR SNSR BD,56X/57X(BOM)
132801	CLIP,Y,570
133246	SPRING,PLUNGER,56X/57X
133248	PINCHER,56X/57X
133996	ASSY,AIL,RECEIVER,57X(BOM)
134857	ASSY,HANDLE/CAP,57X(BOM)
136740	KIT,CVR ASSY,CE,SWED,571
139753	FLEX CBL,RFI,571/572
140787	CBL,FLEX,56X/57X
141176	SERV ASSY,PRES,VACUUM,57X
141553	KIT,COVER ASSY,CE,ITAL,571
141555	KIT,COVER ASSY,CE,ENG,572
141574	SHIELD,ACC INTFC BD,57X

Body Assembly Parts *(continued)*

Part Number	Description
141590	ASSY,ACC INTFC BD,CAL,57X(BOM)
145271	STRAIN RELIEF,CBL,57x
145272	KIT,STRAIN RELIEF/FLEX CBL,571/572
300034	SCREW,MACH 6-32X3/8 PNH PHH
300036	NUT,KEP 6-32 S PL
300038	WSHR,FL,.174X.380X.032,PS
300055	SCREW,MACH 8-32X1/4 PNH PHH
300330	SCREW,MACH 6-32X1/4 PNH PHH
300347	SCREW,MACH 4-40X5/8 PNH PHH
300371	SCREW,MACH 8-32X5/8 PNH PHH
300389	WSHR,INT TTH,.146X.283X.019,P
301164	SCREW,CAP 6-32X1/4 FLH HXSO
301749	BUMPER,MLD 2093 W/ST WSHR INS
302876	PULLEY, TMG 24 GRV 0.080P
302878	BELT,TMG 79GRV 0.080P
302902	FSTNR,SPD NUT LKG 0.250 SSTUD
303106	CLIP,CORD,.18 DIA,ADH BK,NYL
303938	SCREW MACH 6-32 X3/8 PNH PHHSS
304172	SCREW,CAP,4-40X1/4,BUTH,HXSO
304209	SCREW,MACH,6-32X3/16,PNH,PHH
304330	SCREW,MACH,8-32X3/8,PNH,PHH,S

Door Assembly Parts

Part Number	Description
125337	COVER,MAGNET
125359	GROMMET,FLEX STRIP
125368	PINCHER,CAM,56X/57X
125413	SHIELD,MYLAR,56X/570
132776	ASSY,LATCH,ENG,(BOM)
132777	ASSY LATCH,GNRC,(BOM)
133132	PLUNGER,PRESSURE,DISC,570XB
133207	SERV ASSY,BEZEL/OVLY,ENG,570
133246	SPRING,PLUNGER,56X/57X
137269	ASSY,AIL,TRANS,571/572(BOM)
137653	CAP,GROUND,POST,571/572
138999	ASSY,BEZEL/OVLY,ENG,572(BOM)
139000	ASSY,BEZEL/OVLY,FREN,571(BOM)
139001	ASSY,BEZEL/OVLY,DUT,571(BOM)
139002	ASSY,BEZEL/OVLY,ENG,571(BOM)
139003	KIT,BEZEL/OVLY,SPAN,571(BOM)
139004	KIT,BEZEL/OVLY,ITAL,571(BOM)

Door Assembly Parts

Part Number	Description
139005	ASSY,BEZEL/OVLY,SWED,571(BOM)
139006	KIT,BEZEL/OVLY,GER,571(BOM)
139007	SERV ASSY,DSPL BD,57X(BOM)
139019	ASSY,SET SNSR,571/572(BOM)
139753	FLEX CBL,RFI,571/572
140787	CBL,FLEX,56X/57X
300345	SCREW,MACH 4-40X1/4 PNH PHH
0000ME00310	WSHR,FL,.4BA T2 ST/STA2
300701	SCREW,MACH 6-32X3/8 TR PHH
301522	SCREW,MACH 8-32X3/8 PNH PHH
301591	SPRING,CVR,WSHR U-138-0045S
301594	WSHR,FL,.187X.438X.020,BLK,SS
302053	PIN,GRV 0.125X1.25 S ALLOY
302269	P,GRV 0.125X.500 REV TPR
302274	DSPL,7/SEG,ORANGE,COM CATH.400
302425	MAGNET,MAGNETIZED,CO 90C98A
302466	SCREW,CAP 4-40X5/8 HXSO
302762	DIODE,LED,YEL,MV53154/HLMP3465
302797	CONN,HDR,LTCH,4P,1X4,RA,AU
302900	SPR,CPRSN,.360X.813X.813X.035,MW
302932	FOAM,0.062TX0.125W GREY
303612	CONN,FL FLEX RTANG 11P 0.100C
303899	DISPLAY,LED,RED,5X7 DOT MATRIX
304172	SCREW,CAP,4-40X1/4,BUTH,HXSO

Software

Part Number	Description
145070	KIT,UPGRD,REV 3.01,570
145071	SERV ASSY,MEM,REV3.01,570(BOM)

Labels

Part Number	Description
125392	LBL,CAUT,ENG
125393	LBL,PRESS TO OPEN,ENG
125406.01	LBL,FLOW SNSR,GER
125406.02	LBL,FLOW SNSR,FREN
125406.03	LBL,FLOW SNSR,DUT
125406.04	LBL FLOW SNSR SWED
125406.05	LBL FLOW SNSR SPAN
125406.06	LBL FLOW SNSR ITAL
125407.01	LBL,CAUT,GER
125407.02	LBL,CAUT,FREN
125407.03	LBL,CAUT,DUT
125407.04	LBL CAUT SWED
125407.05	LBL CAUT SPAN
125407.06	LBL CAUT ITAL
125450.01	LBL,FLOW ARROW,GER
125450.02	LBL,FLOW ARROW,FREN,56X/57X
125450.03	LBL,FLOW ARROW,DUT
125450.04	LBL FLOW ARROW SWED
125450.05	LBL FLOW ARROW SPAN
125450.06	LBL FLOW ARROW ITAL
125451.01	LBL,PRESS TO OPEN,GER
125451.02	LBL,PRESS TO OPEN,FREN,56X/57X
125451.03	LBL,PRESS TO OPEN,DUT
125451.04	LBL PRESS OPEN SWED
125451.05	LBL,PRESS TO OPEN,SPAN
125451.06	LBL PRESS OPEN ITAL
125452.01	LBL,PRES XDCR,GER
125452.02	LBL,PRES XDCR,FREN
125452.04	LBL,PRES XDCR,SWED
125452.05	LBL,PRES XDCR,SPAN
125452.06	LBL,PRES XDCR,ITAL
125497	LBL,FLOW ARROW,ENG
125569	LBL,S/N RPLCMNT
132152	LBL,FLOW SNSR PLCMT,ENG,57X
132394	LBL,HANDLE,LWR,ENG,57X
132712	LBL,FLOW SNSR PLCMT,FREN,570/1
132713	LBL, HANDLE, LWR, FREN, 57X
133207	SERV ASSY,BEZEL/OVLY,ENG,570
133208	LBL,TBG POSN,57X
133215	LBL,PRES XDCR,ENG,57X(BOM)
133318	LBL,EQ POT CONN
133430	LBL,TBG,POSN,FR/CAN,570

Labels *(continued)*

Part Number	Description
135382	LBL HANDLE LWR GER 571
135383	LBL FLOW SNSR PLCMT GER 571
135386	LBL TBG POSN GER 571
135539	LBL HANDLE UPR 571
135589	LBL VPVP FREN 571 (BOM)
135590	LBL VPVP GER 571 (BOM)
135990	LBL,VPVP,ENG,572(BOM)
135992	LBL,HANDLE,UPR,572
136933	LBL CE MARK INST MDD
137329	LBL,START-UP,DUT,571(BOM)
137330	LBL,PUSH TO RESET,DUT,571
137333	LBL START UP SPAN 571(BOM)
137463	LBL,START-UP,ENG,572(BOM)
137475	LBL,PUSH TO RESET,FREN,571
137476	LBL PUSH TO RESET GER 571
137496	LBL,NAME RATING,ENG,571/572
137641	LBL PUSH TP RESET ITAL 571
137642	LBL START UP ITAL 571(BOM)
137644	LBL NAME RATING ITAL 571
137645	LBL PUSH TO RESET SWED 571
137646	LBL START UP SWED 571(BOM)
137648	LBL NAME RATING SWED 571
137649	LBL VPVP ITAL 571 (BOM)
137651	LBL VPVP SWED 571 (BOM)
137656	LBL VPVP SPAN 571 (BOM)
137658	LBL,VPVP,DUT,571(BOM)
137682	LBL HANDLE LWR ITAL 571(BOM)
137683	LBL HANDLE LWR SWED 571(BOM)
137684	LBL, HANDLE, LWR, SPAN, 571
137685	LBL HANDLE LWR DUT 571(BOM)
137687	LBL TBG POS ITAL 571(BOM)
137688	LBL TBG POS SWED 571(BOM)
137689	LBL TBG POS SPAN 571(BOM)
137690	LBL TBG POS DUT 571(BOM)
137692	LBL FLOW SNSR PLCMT ITAL 571
137693	LBL FLOW SNSR PLCMT SWED 571
137694	LBL FLOW SNSR PLCMT SPAN 571
137695	LBL,FLOW SNSR PLCMT,DUT,571
137839	LBL, START-UP, FREN, 571 (BOM)
137841	LBL, START-UP, GER, 571 (BOM)
137845	LBL PUSH TO RESET SPAN 571

Labels *(continued)*

Part Number	Description
137847	LBL,NAME RATING,DUT,571
137848	LBL NAME RATING SPAN 571
137854	LBL,PATENT NTC,571/572
137960	LBL,NAME RATING,FREN,571
138656	LBL START UP ENG 571 (BOM)
138658	LBL VPVP ENG 571 (BOM)
138999	ASSY,BEZEL/OVLY,ENG,572(BOM)
139000	ASSY,BEZEL/OVLY,FREN,571(BOM)
139001	ASSY,BEZEL/OVLY,DUT,571(BOM)
139002	ASSY,BEZEL/OVLY,ENG,571(BOM)
139003	KIT,BEZEL/OVLY,SPAN,571(BOM)
139004	KIT,BEZEL/OVLY,ITAL,571(BOM)
139005	ASSY,BEZEL/OVLY,SWED,571(BOM)
139006	KIT,BEZEL/OVLY,GER,571(BOM)
10012829	LBL, WEEE Symbol

Test Equipment & Accessories

Part Number	Description
0000ME00672	ADHESIVE LOCTITE 243
0000ME00753	ADHESIVE LOCTITE 496
10013003	Sheet, WEEE Symbol Notice
132350	ASSY,MODE SELECT BD,57X(BOM)
142109	ASSY,TEST JMPR,57X (BOM)
180	FLOW SENSOR

Appendix C

Configured Options

Configured Options Record Sheet
IVAC® Volumetric Pump (Models 571 & 572)

Enter the pump-specific information for your records

Test ID	Setting	Range/Options	Default	Hospital Setting
9*	Rate Configuration	STANDARD = 001 - 999 ml/h ALL RATE = 0.1 - 999.9 ml/h	STANDARD	
10	Maximum Rate	STANDARD RATE CONFIG = 999 ml/h ALL RATE CONFIG = 0.1 - 999.9 ml/h	999	
11*	VTBI Configuration	STANDARD RATE CONFIG: MACRO = 9999 ml ALL RATE CONFIG: MACRO = 1 - 9999 ml MICRO = 0.1 - 999.9 ml	MACRO	
14	Maximum Occlusion Pressure	0 - 500 mmHg / 0 - 680 cmH_20	500 (mmHg) or 680 (cmH_2O)	
15	Default Occlusion Pressure	0 - 500 mmHg / 0 - 680 cmH_20	500 (mmHg) or 680 (cmH_2O)	
20	Secondary Mode Completion Tone (Model 572 only)	4 BEEPS / 1 CLICK	4 BEEPS	
23	Language	ENGLISH/DUTCH/FRENCH/GERMAN/ ITALIAN/SPANISH/SWEDISH	ENGLISH	
24	Computer Interface Module	OFF / 1 - 999 (CIM ID number) Note: If CIM not fitted, ensure setting is OFF	OFF	
25	Alarm Tone	HI TONE / MED TONE / LOW TONE	MED TONE	
26*	AIL Alarm Threshold	50 - 150 microlitres (in 10 µl increments)	100	
31*	Infusion Mode	Model 571: PRI (PRIMARY) only Model 572: SEC/CRIS (SECONDARY) or PRI (PRIMARY)	PRI (571) SEC/CRIS (572)	

* Mode Select Jumper required

Model: ***Serial No:*** ***Software Version:***

Configured by: _____ ***Date:*** _____

Approved by: _____ ***Date:*** _____

Appendix D

Disposal

Disposal

Information on Disposal for Users of Waste Electrical & Electronic Equipment

This symbol on the product and/or accompanying documents means that used electrical and electronic products should not be mixed with municipal waste.
If you wish to discard electrical and electronic equipment, please contact your Cardinal Health affiliate office or distributor for further information.
Disposing of this product correctly will help to save valuable resources and prevent any potential negative effects on human health and the environment which could otherwise arise from inappropriate waste handling.

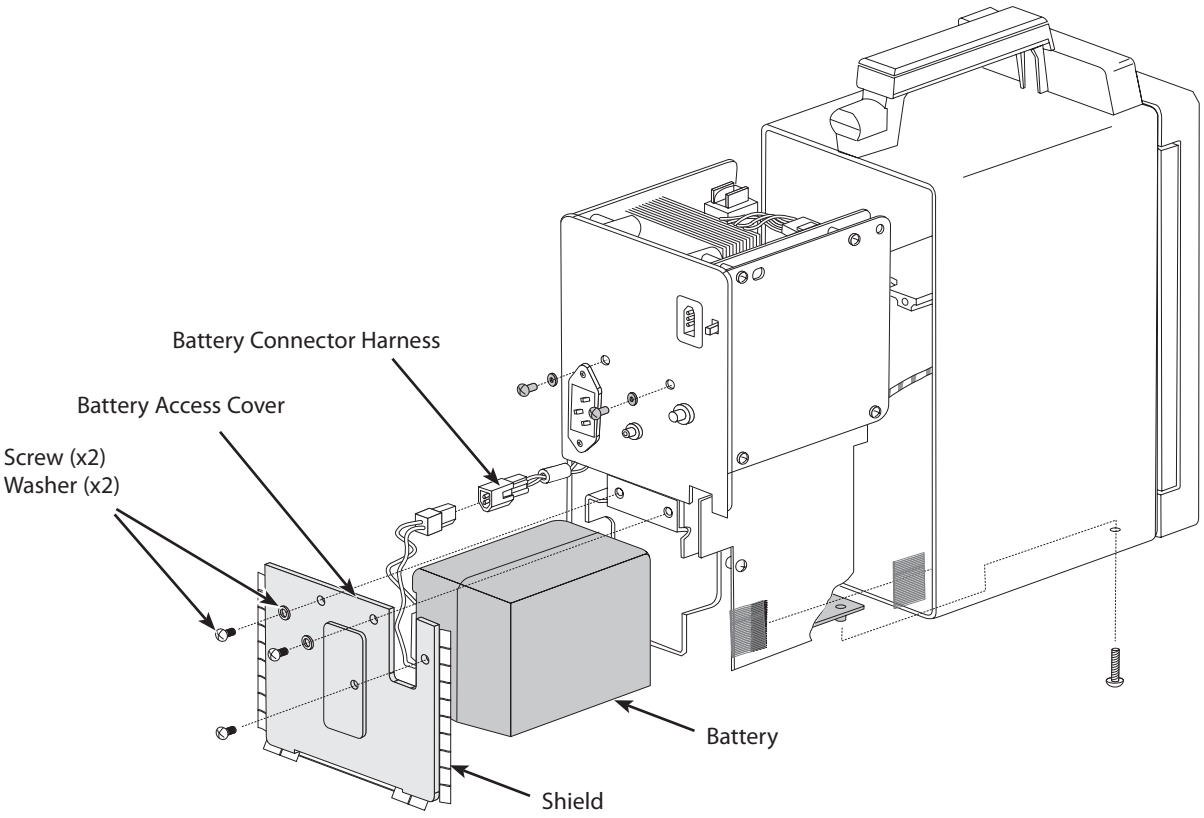
Information on Disposal in Countries outside the European Union
This symbol is only valid in the European Union. The product should be disposed of taking environmental factors into consideration. To ensure no risk or hazard, remove the internal rechargeable battery and dispose of as outlined by the local country regulations. All other components can be safely disposed of as per local regulations.

Battery Removal

Removal Procedure

Remove the two screws and washers securing the battery access cover then remove the battery access cover and shield.

Slide out the battery pack and unplug the battery connector.



Appendix E

Service Contacts

Service Contacts

For service, contact your local Cardinal Health Affiliate Office or Distributor.

AE

Cardinal Health,
PO Box 5527,
Dubai, United Arab Emirates.
Tel: (971) 4 28 22 842
Fax: (971) 4 28 22 914
www.cardinalhealth.com/international/distributors/alaris

AU

Cardinal Health,
3/167 Prospect Highway,
PO Box 355
Seven Hills, NSW 2147,
Australia.
Tel: (61) 2 9838 0255
Fax: (61) 2 9674 4444
www.cardinalhealth.com/au
techservice-au@cardinal.com

BE

Cardinal Health,
Otto De Mentockplein 19,
1853 Strombeek - Bever,
Belgium.
Tel: (32) 2 267 38 99
Fax: (32) 2 267 99 21
www.cardinalhealth.com/be
tech.benelux@cardinal.com

CA

Cardinal Health,
235 Shields Court,
Markham,
Ontario L3R 8V2,
Canada.
Tel: (1) 905-752-3333
Fax: (1) 905-752-3343
www.cardinalhealth.com/ca

CN

Cardinal Health,
Shanghai Representative Office,
Suite 9B,
Century Ba-Shi Building,
398 Huai Hai Rd(M.),
Shanghai 200020,
China.
Tel: (56) 8621-63844603
Tel: (56) 8621-63844493
Fax: (56) 8621-6384-4025

DE

Cardinal Health,
Pascalstr. 2,
52499 Baesweiler,
Deutschland.
Tel: (49) 2401 604 0
Fax: (49) 2401 604 121
www.cardinalhealth.com/de

DK

Cardinal Health,
Postboks 29,
2820 Gentofte,
Danmark.
Tlf. (45)70 20 30 74
Fax. (45)70 20 30 98

ES

Cardinal Health,
Edificio Veganova,
Avenida de La Vega, nº1,
Bloque 1 - Planta 1,
28108 Alcobendas, Madrid,
España.
Tel: (34) 91 657 20 31
Fax: (34) 91 657 20 42
www.cardinalhealth.com/es
servicio.tecnico@cardinal.com

FR

Cardinal Health,
Immeuble Antares - Technoparc,
2, rue Charles-Edouard Jeanneret.
78300 POISSY,
France.
Tél: (33) 1 30 06 74 60
Fax: (33) 1 39 11 48 34
www.cardinalhealth.com/fr
FR-Assistance-Technique@cardinal.com

GB

Cardinal Health,
The Crescent, Jays Close,
Basingstoke,
Hampshire, RG22 4BS,
United Kingdom.
Tel: (44) 0800 917 8776
Fax: (44) 1256 330860
www.cardinalhealth.com/alaris
UK-Technical-Support@cardinal.com

HU

Cardinal Health,
Döbrentei tér 1,
H-1013 Budapest,
Magyarország.
Tel: (36) 14 88 0232
Tel: (36) 14 88 0233
Fax: (36) 12 01 5987
AlarisCE@cardinalhealth.com

IT

Cardinal Health,
Via Ticino 4,
50019 Sesto Fiorentino,
Firenze, Italia.
Tél: (39) 055 30 33 93 00
Fax: (39) 055 34 00 24
www.cardinalhealth.com/it
assistenza.tecnica@cardinal.com

NL

Cardinal Health,
Kantorenpand "Hoefse Wing",
Printerweg, 11,
3821 AP Amersfoort,
Nederland.
Tel: (31) 33 455 51 00
Fax: (31) 33 455 51 01
www.cardinalhealth.com/nl
tech.benelux@cardinal.com

NO

Cardinal Health
Solbråveien 10 A,
1383 ASKER,
Norge.
Tel: (47) 66 98 76 00
Fax: (47) 66 98 76 01
www.cardinalhealth.com/no
technical.supportNO@cardinal.com

NZ

Cardinal Health,
14B George Bourke Drive,
Mt Wellington 1060,
PO Box 14-518,
Panmure 1741, Auckland,
New Zealand
Tel: 09 270 2420
Freephone: 0508 422734
Fax: 09 270 6285
www.cardinalhealth.com/nz
techservice-nz@cardinal.com

SE

Cardinal Health,
Hammarbacken 4B,
191 46 Sollentuna,
Sverige.
Tel: (46) 8 544 43 200
Fax: (46) 8 544 43 225
www.cardinalhealth.com/se
technical.supportSE@cardinal.com

US

Cardinal Health,
10020 Pacific Mesa Blvd.,
San Diego, CA 92121,
USA.
Tel: (1) 858 617 2000
Fax: (1) 858 617 2900
www.cardinalhealth.com/alaris

ZA

Cardinal Health,
Unit 2 Oude Molen Business Park,
Oude Molen Road, Ndabeni,
Cape Town 7405, South Africa.
Tel: (27) (0) 860 597 572
Tel: (27) 21 510 7562
Fax: (27) 21 5107567
www.cardinalhealth.com/za
SA-Technical-Support@cardinal.com

Appendix F

Document History

Document History

Document	*Date*	*CO No.*	*Author*	*Description*
10064298 (1000SM00018 Issue 1)	October 06	514769 (6169)	Clare Coney	Initial release
1000SM00018 Issue 2	February 08	7989	Ian Tyler	Update troubleshooting table with downstream occlusion alarm.